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THE CYTOLOGY OF CONJUNCTIVAL EXUDATES*

PHILLIPS THYGESON, M.D.
San Jose, California

Since Herbert,[1] in 1903, first called attention to the importance of conjunctival eosinophilia in the diagnosis of vernal catarrh, a number of cytologic studies[2] of epithelial scrapings and conjunctival exudates have been reported in the literature. The knowledge gained from these investigations, however, has not led to any general use of cytologic analysis in the diagnosis of ocular infections. It would seem that, in fields other than ophthalmology, the diagnostic importance of cell types has been more generally recognized. In hematology, cell study is of major importance, and in meningitis cell studies of spinal fluid are made routinely and are of great clinical significance, in both diagnosis and prognosis. Studies of peritoneal exudates[3] and of exudates from the nose and throat are also commonly made, and more recently, cytologic examination[4] has come into general use in gynecology, particularly in connection with cervical malignancies. It seemed pertinent, therefore, to review and extend at this time the knowledge of conjunctival cytology and, if possible, to determine the diagnostic value of cytologic analysis in conjunctival disease.

MATERIAL AND METHODS

The present report is based on studies of conjunctival scrapings, exudates, and follicular expressions made over a period of 10 years and comprising more than 2,000 examinations. Most of the cases were observed in the external-disease clinic of the Vanderbilt Clinic, New York, but there were also a number of private cases seen in consultation, and of Army cases seen chiefly at Drew Field, Florida, during the period 1943-45. In all cases, the cytologic findings were correlated with both bacteriologic findings and clinical observations.

Staining. The Giemsa stain was used routinely. The slides were allowed to dry in air, fixed in absolute methyl alcohol for five minutes or longer, and then stained in a dilute Giemsa solution consisting of one drop of stock Giemsa solution in 1 c.c. of neutral distilled water. A staining period of about an hour was usually required. The slides were then passed rapidly through two changes of 95-percent alcohol in order to remove stain debris. A number of other stains were employed in special cases. The Army slides were stained with Wright's stain, owing to the difficulty of obtaining Giemsa solution, and a number of slides from cases of allergic conjunctivitis were stained with the Hansel[5] stain for eosinophils. May-Grünwald fixation was occasionally substituted for methyl-alcohol fixation, when there was need for immediate examination of the preparation, since it reduced the time of Giemsa staining to only 10 or 15 minutes. In general, however, the routine Giemsa stain ap-

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peared to be entirely satisfactory for all purposes and was considered the stain of choice.

Types of exudate cells

In the exudates from the various conjunctival inflammations observed in this series, all the known leukocytes were seen and were, in almost all cases, well preserved and easy to recognize. Plate 1 illustrates the cells most commonly found. Identification of polymorphonuclear leukocytes, eosinophils, basophils, lymphocytes, and plasma cells presented no difficulty, but the large lymphocytes were occasionally hard to differentiate from the monocytes. A number of morphologic types of macrophages were observed in follicular expressions, but by far the most common was the extremely large macrophage which has been described under the name "Leber cell."

The presence of free eosinophilic and basophilic granules appeared to offer some diagnostic information, and their presence or absence was noted routinely. Marked variation in the amount of mucus was recorded and, as will be noted later, excessive amounts were found to be characteristic of two types of conjunctival inflammation. The high fibrin content of certain conjunctival exudates was easily recognized in Giemsa-stained slides, as fibrin takes a red color. In epithelial scrapings, changes in the epithelial cells (other than the inclusion bodies which will not be considered in this report) were found to have diagnostic significance. The most important of these changes were: (1) An increase in the number of goblet cells; (2) Partial or complete epithelial-cell keratinization.

Significance of a polymorphonuclear-leukocyte reaction

The most frequent cytologic reaction seen in acute and chronic conjunctivitis was a polymorphonuclear-leukocyte reaction. With only two exceptions, namely, Neisseria catarrhalis and diplobacillary infections, all bacterial infections of the conjunctiva induced this type of cell reaction. Variations in intensity were noted in the various stages of the inflammations. For example, in acute purulent infections, such as gonorrheal ophthalmia, the leukocytic reaction was extremely intense and accompanied by more fibrin than mucus; but in later stages of the same diseases, an increase in the number of mononuclear cells occurred, with a drop in the amount of fibrin and an increase in mucus. Never in these bacterial infections, however, did the mononuclear cells become predominant. In general, chronic infections tended to show a higher percentage of mononuclear cells, even though the polymorphonuclears were always predominant. It was interesting to note, however, that in staphylococcic conjunctivitis, whether acute or chronic, an extremely high percentage of polymorphonuclears was almost always demonstrable in the exudate, a much higher percentage, for example, than in the exudate of E. coli conjunctivitis.

Several types of conjunctivitis, whose etiology is as yet unknown, also showed an almost purely polymorphonuclear leukocyte reaction. Among these were all 12 of the cases of conjunctivitis associated with erythema multiforme, one case of conjunctivitis in Reiter's disease, and four cases in psoriasis arthropathica.

The two exceptions among bacterial infections in which polymorphonuclear exudates were lacking are of some interest. Among the 50-odd cases of diplobacillary conjunctivitis studied, polymorphonuclear exudates were found only when there was secondary infection with staphylococci, never in pure infections. The exudates were characterized by their high fibrin content (fig. 1) and their

deficiency in mucus. The fact that the diplobacillus is not a pyogenic organism has been stressed by many authors since its discovery by Morax in 1896. Only five cases of N. catarrhalis conjunctivitis were observed in this series, but all of them were characterized by an extraordinary lack of leukocytes combined with an extraordinary abundance of bacteria. These infections were all mild and amenable to therapy, but it is recognized that acute conjunctivitis can be produced by this organism. According to Swan,[6] N. catarrhalis is the cause of an acute catarrhal conjunctivitis in Oregon. In his cases, there were numerous polymorphonuclear leukocytes in smears and scrapings. Further study of this organism is clearly indicated.

It should, perhaps, be noted here that in three cases of conjunctivitis due to C. diphtheriae, very few leukocytes were found in the exudates, but that, among the few found, the polymorphonuclear cells were definitely in the majority.

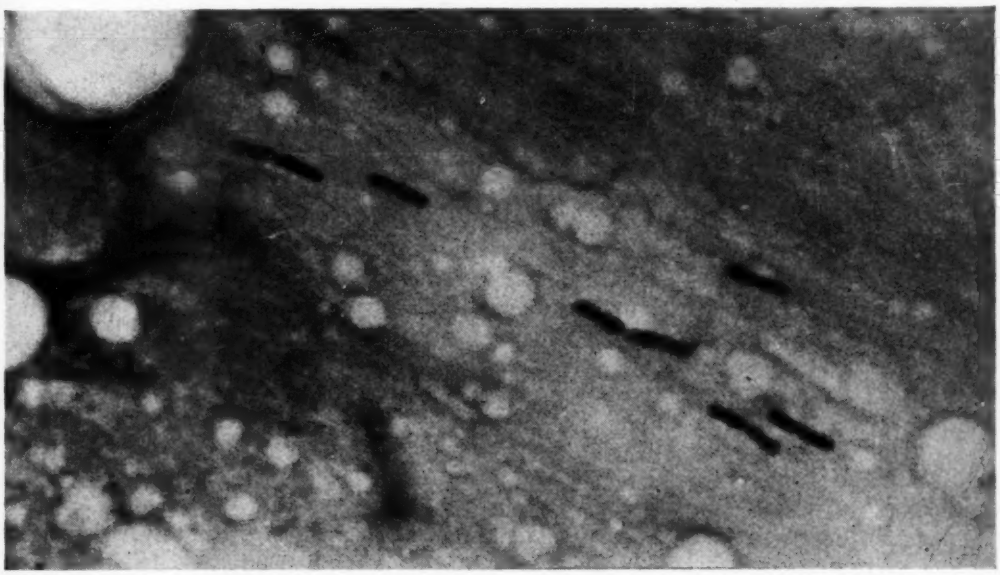


Fig. 1 (Thygeson). Fibrinous exudate without leukocytes in diplobacillary conjunctivitis. Gram stain. (×1,350).

Significance of an eosinophil reaction

The demonstration of a conjunctival eosinophilia has long been considered of diagnostic importance in vernal catarrh. In the more than 100 cases studied in this series, eosinophils could invariably be demonstrated during the active stages of the disease and usually also during the quiescent period. Demonstration was at times difficult but never impossible in a case showing clinical symptoms. There was an extraordinary degree of fragmentation of the eosinophils with liberation of free granules. In an active case, these free granules appeared either singly or in clumps in every oil-immersion field. Their demonstration was found to be of value in mild cases of the disease in which the number of eosinophils was relatively small.

Unfortunately, the eosinophil is not specific for vernal catarrh, but it is the characteristic cell of allergic inflammation and was readily demonstrable in this series

in cases of hay-fever conjunctivitis and in various drug and cosmetic allergies. It is noteworthy that eosinophils were not demonstrated in eserine and pilocarpine conjunctivitis but were found consistently in conjunctivitis due to atropine sensitization. In the writer's opinion, this observation has significance as an indication that eserine conjunctivitis, as has already been suggested from clinical observations, is ordinarily a toxic rather than an allergic reaction.

In 40 cases of phlyctenular conjunctivitis, a disease which is most certainly a bacterial allergy, there were no eosinophils whatever. This is consistent with the findings in other bacterial allergies; namely, the tuberculin reaction, in which the eosinophils are not the characteristic cells. Apparently, nucleoprotein does not have the property of calling forth this type of cell.

In 17 cases of ocular pemphigus and in one case of acute pemphigus with ocular signs and fatal outcome, mild conjunctival eosinophilia was demonstrable but not to be compared wth the intense reaction characteristic of typical allergic conjunctivitis. In this series, there were no cases of conjunctivitis due to parasites, but it is likely that any such conjunctivitis would present a conjunctival eosinophilia. The allergic nature of the eosinophilia of parasitic infections has been well demonstrated.[7] In six cases of bulbar chemosis associated with trichinosis, there was no conjunctival exudate at all, and bulbar scrapings failed to show any eosinophils. An intense blood eosinophilia was demonstrable in all these cases, however, and it is interesting to note in this connection that 10 cases of blood eosinophilia without conjunctivitis failed to show eosinophils in conjunctival scrapings. On the other hand, it is well known that a blood eosinophilia is commonly found in vernal catarrh, conjunctival allergies of various sorts, and ocular pemphigus, indicating the systemic nature of many of these ocular inflammations.

In this series, a number of acute conjunctivitis cases, apparently due to Staph. aureus, showed numerous eosinophils in the exudates. On first consideration, it seemed that they might have been caused by a drug allergy incident to therapy, or that the conjunctivitis might be of allergic origin, the bacteria acting as secondary invaders only, but these possibilities were soon discarded. The most logical explanation seemed to be that an allergy to staphylococcic toxin had developed, and studies to prove or disapprove this hypothesis are now under way.

Significance of a basophil reaction

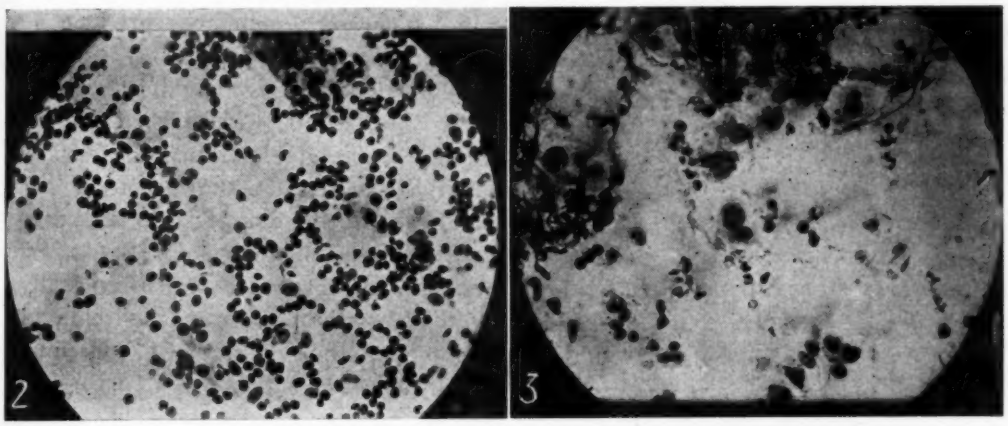
A conjunctival basophilia was seen in allergic inflammations of the conjunctiva, particularly vernal catarrh. In this disease, the basophils were occasionally more numerous than the eosinophils, and their presence in large numbers appeared to have definite diagnostic significance. This was a particularly interesting finding in view of the fact that the basophil is such a prominent cell and so easily recognized on low-power examination. There seemed to be no doubt that its occurrence in general paralleled the occurrence of the eosinophil, but its relation to allergy was by no means so specific. Whereas eosinophils were almost never seen in ordinary bacterial infections or in trachoma, small numbers of basophils were not infrequenty demonstrable in these nonallergic inflammations. Large numbers, however, were characteristic only of allergic inflammations. Free basophilic granules were usually demonstrable when basophils were present, indicating a fragmentation comparable to the fragmentation of the eosinophils.

Significance of a mononuclear-cell reaction

Mononuclear cells, and the lymphocyte in particular, were consistently the predominant cells in exudates, smears, and scrapings from epidemic keratoconjunctivitis and acute follicular conjunctivitis, Béal; in the exudates, in fact, almost 100 percent of the cells (fig. 2) were mononuclear. Only in a few cases in which there was secondary infection with staphylococci were there any appreciable numbers of polymorphonuclear cells. The preponderant cell was the small lymphocyte, but there were variable numbers of large mononuclear cells, most of them monocytes. Some difficulty was encountered in differentiating monocytes with round nuclei from large lymphocytes, but differentiation did not seem to be important. No reason could be advanced to indicate why the large mononuclear leukocytes were more prominent in one case than in another of the same disease.

It is of interest that the only case of acute herpetic conjunctivitis and three cases of conjunctivitis secondary to molluscum-contagiosum nodules of the lid margins showed pure mononuclear cell reactions. This was consistent with the generally recognized fact that a lymphocytic reaction is the usual cell reaction to the typical viruses. In fact, the only pyogenic viruses known to involve the conjunctiva—namely, the viruses of trachoma (fig. 3), inclusion conjunctivitis, and lymphogranuloma venereum — cannot be classed as typical viruses and are soon to be placed in a separate category.[8]

In mononuclear-cell exudates, as well as in certain polymorphonuclear-cell exudates in which a significant proportion of the cells were monocytes, many shadow forms of the monocytes occurred. These shadow forms consisted of degenerated nuclei in which the mesh of the chromatin network had become widened to form many bizarre shapes and forms. While there was a certain variation in their number in the various conjunctivitides, no diagnostic significance could be ascribed to them.



Figs. 2 and 3 (Thygeson). Fig. 2, Mononuclear cell exudate in acute follicular conjunctivitis, Béal. Giemsa stain. (×350). Fig. 3, Polymorphonuclear leukocytes in exudate from acute trachoma. Giemsa stain. (× 350).

Significance of a plasma-cell reaction

In spite of the well-known occurrence of plasma cells in the subepithelial infiltrate in many types of conjunctivitis,

plasma cells in the exudates and epithelial scrapings in this series were extraordinarily rare. In fact, with only a few exceptions, plasma cells were seen only in the scrapings and exudates from trachoma. According to Wilson,[9] the plasma cell is the most important cell in the subepithelial infiltrate in trachoma, where it occurs in large numbers, and it is of interest that plasmomas not infrequently occur in chronic trachoma of high in-

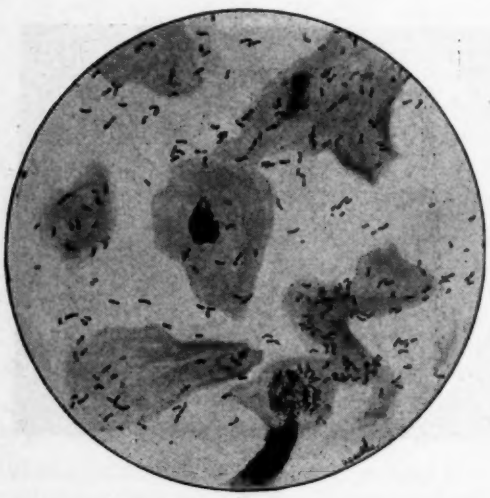


Fig. 4 (Thygeson). Epithelial scrapings from the bulbar conjunctiva of a patient with vitamin-A deficiency. Giemsa stain. Drawn from a magnification of 1,350.

tensity. The plasma cells in trachoma exudates in this series were never very numerous but were easily recognized and distinctive. It is believed that their presence has some diagnostic importance.

It is not certainly known whether the plasma cell has the ability to pass through the epithelial barrier of the conjunctiva or is seen merely as the result of the rupturing of trachoma follicles. As will be noted later, the gelatinous, necrotic trachoma follicles rupture easily, even spontaneously, and it would therefore seem logical to expect plasma cells contained in the periphery of the follicles to appear in epithelial scrapings and exudate smears.

Significance of epithelial changes

In vitamin-A deficiency of advanced degree, there is a tendency of the conjunctival and corneal epithelium to become keratinized. This is a characteristic of the conditions known variously as xerosis, xerophthalmia, and keratomalacia. In these conditions, the keratinization is grossly visible, and microscopic study unnecessary. Mild degrees of vitamin-A deficiency sometimes produce the condition known as prexerosis, in which the epithelial changes are mild and localized. Bitôt's spots, which are small, triangular areas of keratinization located selectively at the temporal limbus, are of some value in the diagnosis of vitamin-A deficiency and, in their early stages, can best be demonstrated microscopically. Epithelial scrapings from the temporal limbus area show keratinized epithelium, usually covered with xerosis bacilli (fig. 4). In Giemsa stains, the cells appear reddish, and the nuclei are absent or degenerated. The normal conjunctival epithelium of this area never shows keratinization or surface bacterial proliferation.

The value of this test has been questioned,[10] but it is believed by the writer to have considerable value, although limited in this country by the relative infrequency of vitamin-A deficiency. In this series of 2,000 cases, for example, only eight instances of keratinization due to vitamin deficiency occurred. It is interesting that one of these was a pellagra due to chronic alcoholism. In the only three of the eight cases which could be followed for any length of time, vitamin-A therapy caused a disappearance of Bitôt's spots and a return of the conjunctival epithelium to normal.

Keratinization of the conjunctival

epithelium may occur, however, without relation to vitamin-A deficiency. It may occur as a result of exposure in old cases of ectropion or as a result of extreme cicatrization, as in old trachoma or ocular pemphigus. These conditions, however, present no diagnostic difficulty and are in no danger of being confused with suspected vitamin-A deficiency.

It should be remembered that the epithelium of the lid margin is normally keratinized and that occasionally keratinized cells from this source may appear in conjunctival smears. This is extremely rare, however, and caused no confusion in this series.

Keratinization without vitamin-A deficiency may also occur in the syndrome of keratoconjunctivitis sicca. In this disease, there is a deficiency of tears which is compensated for by the production of excessive amounts of mucus. While the conjunctival epithelium never becomes fully keratinized as in vitamin-A deficiency, the cells from an advanced case characteristically show keratin granules in the cytoplasm and degenerative changes in the nuclei. These changes (fig. 5) are so characteristic as to be of diagnostic significance. An extraordinary increase in the number of goblet cells in scrapings and an excessive amount of mucus complete a characteristic microscopic picture.

According to various authors, notably Feldmann[11] and Taborisky,[12] there are epithelial changes in trachoma other than the cytoplasmic inclusions which have diagnostic significance. Feldmann states that an early diagnosis of trachoma can be made from a study of scrapings from the tarsal conjunctiva. She states that in scrapings from the normal conjunctiva the epithelial cells come off in sheets, the nuclei are oval and of uniform size, and the staining of the nuclei is uniform and saturated. In trachoma, she notes that the polymorphism of the epithelial cells is striking, that they tend to appear in scrapings as isolated cells rather than in sheets, and that their nuclei are round, variable in size, and larger than usual, staining irregularly and less intensely. She indicates that these observations were consistent in 356 cases of trachoma.

According to Taborisky, a cytodiagnosis of trachoma can be made as early as the fifth day of the disease. The normal cylindrical cells of the conjunctiva become flattened, and the nuclei show characteristic changes consisting of thickening and poor staining of the chromatin network with irregularities in the nuclear membranes. He believes that these changes occur in no other type of conjunctivitis.

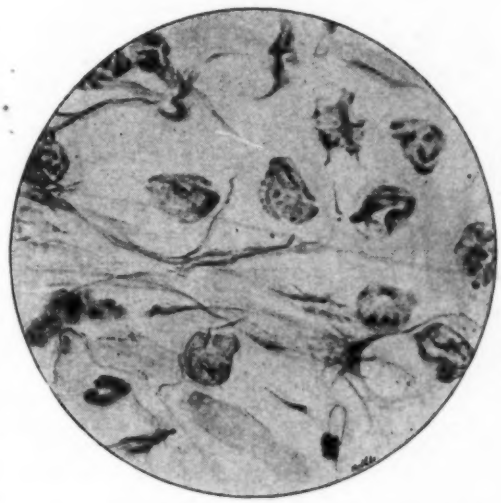


Fig. 5 (Thygeson). Mucus and partially keratinized epithelial cells in conjunctival scrapings from keratoconjunctivitis sicca. Giemsa stain. Drawn from a magnification of 1,350.

Observations on the 125 cases of trachoma in this series, however, failed to show epithelial changes which could be considered specific. It was true that the epithelial cells in trachoma tended to show polymorphism and irregular stain-

ing, but these same morphologic variations were also seen in cases of nontrachomatous conjunctivitis, particularly long-standing conjunctivitis. As will be stressed later, I consider the cytologic findings in expressed follicular material to be much more characteristic of trachoma than any epithelial changes.

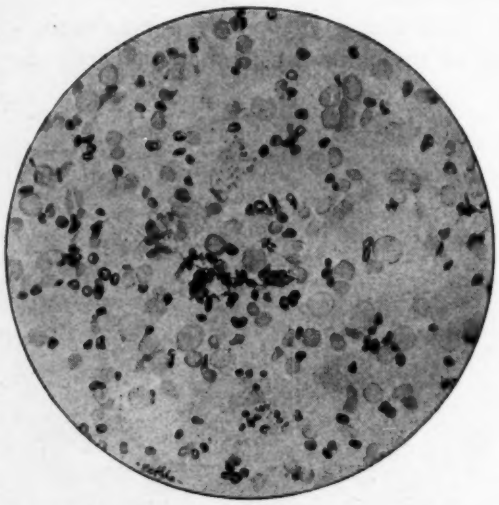


Fig. 6 (Thygeson). Follicular expression from trachoma, showing Leber cells, degenerated lymphoblasts, and cell debris. Giemsa stain. Drawn from a magnification of 1,350.

Cytology of expressed follicular material

An extensive study was made of follicular expressions from trachoma and from nontrachomatous follicular conjunctivitis of various types. No difficulty was encountered in obtaining satisfactory preparations from trachoma, since the follicles were soft, gelatinous, and easily expressed. In contrast, all the nontrachomatous follicular conjunctivitides had hard, nonexpressible follicles from which material could be obtained only as a result of vigorous manipulation with ring forceps.

There was a very decided and diagnostic difference between the cytologic picture (fig. 6.) of the trachoma material and of the material from the other diseases. In trachoma, the predominant cell was the germinal-center cell, believed to be a lymphoblast. In lesser numbers were lymphocytes, plasma cells, occasional monocytes, and macrophages. The lymphoblasts had a very characteristic appearance. They showed many degenerative changes, varying in intensity from pallor of the nuclei to loss of cytoplasm. Scattered throughout the slide were many clumps of cell debris, mostly cytoplasmic. The appearance of the macrophages was also distinctive. They were the large macrophages (Leber cells), sometimes several times the size of epithelial cells, and contained in their cytoplasm masses of phagocytosed cell debris, largely nuclear in origin. In slides from typical active trachoma these large macrophages or Leber cells were quite numerous, as many as 25 occurring in a single slide. Ordinarily, however, their number varied between 5 and 20 per slide. Altogether a very characteristic cytologic picture was observed in every case of active trachoma.

A quite different cytologic picture was seen in nontrachomatous follicular material. Here the small mononuclear cells, mostly lymphocytes, were predominant, and there were none of the degenerative changes so characteristic of trachoma. The small number of lymphoblasts present showed normal staining and never any cytoplasmic fragmentation. There was almost complete absence of the cell debris so characteristic of trachoma. Macrophages were occasionally seen, however, but their number was never comparable to the number seen in trachoma, and there were no typical Leber cells.

The explanation for the differences in the cytologic pictures of the two types of

follicular disease probably lies in the necrotizing action of trachoma toxins. It is, of course, the cell necrosis in trachoma which results in the cicatrization so characteristic of the disease and which is completely absent from all the other follicular diseases. It is also interesting to speculate on the reason for the predominance of the large mononuclear, germinal-center cells in trachoma and for their paucity in the nontrachomatous diseases. This is probably due to the fact that the trachoma follicles are necrotic and express easily in such a way that only the germinal-center material is lost, whereas, in follicular conjunctivitis, the whole follicle has to be extirpated in order to get a satisfactory smear. In a

TABLE 1

CYTOLOGY OF CONJUNCTIVAL EXUDATES

	Polymorphonuclear Cells	Mononuclear Cells	Eosinophils	Basophils	Free Eosinophilic and Basophilic Granules	Fibrin Exudate	Mucus Predominant	Follicular Expression			
								Macrophages	Lymphoblasts Predominant	Lymphocytes Predominant	Necrosis of Follicle Cells
Bacteria											
N. gonorrhoeae	+										
N. meningitidis	+										
N. catarrhalis						+					
Staph. aureus	+										
Strep. hemolyticus	+										
viridans	+										
nonhemolyt.	+										
H. conjunctivitidis (Koch-Weeks)	+										
H. influenzae	+						+				
Diplobacillus (Morax-Axenfeld)						+					
Coliform bacilli	+										
Vincent's angina organisms	+										
Fungi											
Streptothrix foersteri	+										
Pityrosporum ovale	0										
Viruses											
Trachoma	+							+	+		+−
Inclusion conj.	+									+	
Lymphogranuloma venereum	+										
Herpes simplex		+									
Epidemic keratoconj.		+									
Béal's conj.		+									
Molluscum contagiosum conj.		+									
Verruca vulgaris conj.		+									
Allergy											
Vernal catarrh			+	+	+						
Hay-fever conj.			+	+	+						
Atropine conj.			+	+							
Eserine conj.			0								
Phlyctenular conj.	+?										

whole follicle, the small mononuclear cells are, of course, more numerous than the germinal-center cells.

Discussion

As was expected, the polymorphonuclear-cell reaction was the most common cytologic feature of exudates from conjunctivitis. In most infections, the demonstration of this reaction pointed to a pyogenic bacterium as the etiologic agent, but there were some notable exceptions. For example, the three atypical viruses of ocular importance, all members of the psittacosis - lymphogranuloma - venereum group of viruses, were all pyogenic. The typical viruses, on the other hand, as exemplified by herpes-simplex virus, induced an almost purely mononuclear-cell reaction. On this basis, the demonstration of polymorphonuclear cells in the exudates of the conjunctivitis from erythema multiforme and psoriasis arthropathica, diseases of unknown etiology, suggests that typical viruses, at least, are not concerned in their etiologies.

The only fungus concerned in conjunctivitis in this series—namely, Streptothrix foersteri,[13] the causative organism of streptothrix concretions of the canaliculus—was also definitely pyogenic, inducing a marked polymorphonuclear-cell reaction in the exudates from the secondary conjunctivitis. On the other hand, the mild conjunctivitis secondary to pure seborrheic blepharitis,[14] and believed to be caused by Pityrosporum ovale, was extraordinarily low in leukocytes. Over half the cases of phlyctenular conjunctivitis in the series were characterized by a polymorphonuclear exudate, but it is noteworthy that there was an almost absolute correlation between this cell reaction and the occurrence of secondary staphylococcic infection. In the few uncomplicated cases, it was difficult to demontrate any leukocytes whatever in the scanty exudate, if indeed there was any exudate at all. When leukocytes were present, they were almost equally divided between polymorphonuclear and mononuclear cells.

As can be seen, therefore, the diagnostic significance of a polymorphonuclear-cell exudate was limited, but there were certain cases in which its demonstration was of decided value. For example, differentiation between the acute follicular conjunctivitis due to inclusion-conjunctivitis virus and Béal's conjunctivitis[15] of still unknown etiology, which at onset are often indistinguishable, could readily be made from an examination of the exudate, since inclusion conjunctivitis has a polymorphonuclear-cell reaction and Béal's conjunctivitis a mononuclear-cell reaction.

The demonstration of a mononuclear-cell reaction was found to have considerably more diagnostic value. As was expected, the typical viruses such as herpes-simplex virus, the virus of epidemic keratoconjunctivitis, and the virus of molluscum contagiosum, induced a lymphocytic reaction which was of considerable value in diagnosis when correlated with clinical and bacteriologic findings. The demonstration of a pure mononuclear-cell reaction in Béal's conjunctivitis suggests strongly that the agent of this infection will eventually be shown to be one of the typical viruses. It must be remembered, however, that there is at least one bacterium—namely, L. monocytogenes—which has the ability to induce a mononuclear-cell reaction. To the best of my knowledge this organism has never been found in human conjunctivitis, however, although an experimental ocular infection in rabbits has been studied by Julianelle.[16]

As was expected, the eosinophil was the cell having the greatest diagnostic value. It is well known that the eosinophil in small numbers may be present in tissue infiltrations without an allergic

basis, but, except for its occurrence in ocular pemphigus, a conjunctival eosinophilia proved to be an almost certain indicator of conjunctival allergy. Conjunctival eosinophilia has been reported in ultraviolet light conjunctivitis[17] and in self-induced conjunctivitis due to ipecac,[18] but the few cases of arc burns in this series showed no leukocytic reaction whatever. There were no cases of self-induced conjunctivitis, and drug conjunctivitis was accompanied by an eosinophilia only when an actual sensitivity had developed. For example, eosinophils were never demonstrable in the silver-nitrate conjunctivitis produced in newborn babies by the Crédé procedure. The fact that ocular pemphigus always showed a mild conjunctival eosinophilia was of some interest but in no way confusing, since the clinical picture of ocular pemphigus was always distinctive enough to eliminate the possibility of typical allergy. Of more significance was the fact that old cicatricial trachoma never showed conjunctival eosinophilia, whereas old cicatricial ocular pemphigus always did. Although differentiation between these two diseases can usually be made on clinical findings alone, a few cases occurred in this series in which the cytologic findings had distinct diagnostic value.

That a conjunctival basophilia usually paralleled a conjunctival eosinophilia was an unexpected finding and one which is believed to have definite diagnostic possibilities. Although isolated basophils were found in many other types of conjunctivitis, they were not found in any considerable numbers except in typical conjunctival allergy. The basophil is a cell more easily recognized than is the eosinophil, particularly by persons with any degree of color-blindness, and can always be recognized with the low-power objective of the microscope.

In this series, no satisfactory study of the granulomatous conjunctivitides was possible. Two cases of tuberculosis with hypertrophic nodules showed no exudates at all; whereas, one with a single conjunctival ulcer showed polymorphonuclear cells as the most common cells in scrapings from the base of the ulcer. As is well known, this leukocyte is seen in tuberculous lesions only when necrosis has taken place. There were six cases of conjunctivitis due to the Leptothrix (Verhoeff[19]), but in only two of these was there sufficient exudate for cytologic examination. In these two cases, polymorphonuclear and mononuclear cells occurred in about equal numbers. There were no cases of tularemia or syphilis.

Cytologic studies of expressed follicular contents from trachoma and from various other etiologic types of follicular conjunctivitis offered considerable diagnostic interest. The phenomenon of necrosis so characteristic of the trachoma follicle was completely absent in the follicles of the other conditions. No diagnostic differences among these other nontrachomatous follicles could be made out, but the differences between them and the trachoma follicle were striking. The significance of this observation is somewhat limited by the fact that the contents of the follicle must be mechanically expressed, but it was found to have definite value in certain atypical cases in which clinical differentiation was not possible. It is believed also that these cytologic changes may be useful in differentiating trachoma follicles from nontrachoma follicles in the same individual in whom trachoma may have supervened on a conjunctiva already showing follicular hypertrophy.

In my opinion, cytologic studies should be a routine part of the examination of conjunctival disease and should be reported simultaneously with the bacteriologic findings.

Summary and Conclusions

1. In a microscopic study of exudate

smears and conjunctival scrapings from 2,000 cases of conjunctivitis of diverse etiology, variations in leukocytic reactions and epithelial changes were found to be sufficiently marked to have diagnostic value.

2. Polymorphonuclear-cell exudates were characteristic of bacterial infections in general, but there were a few exceptions. Diplobacillary conjunctivitis was characterized by a fibrinous exudate without leukocytes unless there was secondary infection with staphylococci. Chronic N. catarrhalis conjunctivitis also showed minimal or no leukocytic reaction.

3. Conjunctivitis produced by the typical viruses always showed a characteristic mononuclear-cell exudate with few, if any, polymorphonuclear cells. In contrast, the three viruses of the psittacosis-lymphogranuloma - venereum group of viruses—namely, trachoma, inclusion conjunctivitis, and lymphogranuloma venereum viruses—always showed a polymorphonuclear-cell exudate.

4. Epithelial changes consisting of various degrees of keratinization were of value in the diagnosis of early vitamin-A deficiency. Mild keratinization of the epithelium combined with an increase in goblet cells and mucus was characteristic of keratoconjunctivitis sicca.

5. A predominance of eosinophils in the exudate was characteristic of vernal catarrh and of typical conjunctival allergies such as hay-fever conjunctivitis. Bacterial allergy, as exemplified by phlyctenular conjunctivitis, showed no eosinophils in the exudate. A conjunctival basophilia was also found in the typical allergies but was neither so constant nor so specific as the eosinophilia. The occurrence of free eosinophilic and basophilic granules released from disintegrating cells was found to have some diagnostic value.

6. The cytology of expressed-follicle contents showed striking differences between the cells of trachoma and those of other follicular conjunctivitides. These differences appeared to be related to the fact that cell necrosis is a striking feature of trachoma but not of the other diseases.

7. The cytologic changes found in this study were in only a few exceptional instances pathognomonic of the etiologic type of conjunctivitis concerned, but when correlated with clinical and bacteriologic findings they were often of distinct diagnostic importance.

8. It is recommended that a statement on cytology be a part of every laboratory report on conjunctival scrapings or exudates.

524 Sainte Claire Building.

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Discussion

Dr. Parker Heath (Detroit, Michigan): Dr. James H. Allen asks: "Can a distinction be made between acute conjunctivitis, type Béal, and epidemic keratoconjunctivitis by cytologic study?"

Dr. Phillips Thygeson (San Jose, California): At the present moment, I don't think any distinction can be made between the cytologic findings in these two diseases. We at one time thought that there were specific inclusion bodies associated with epidemic conjunctivitis; that is, bluish, amorphous bodies in the cytoplasm of conjunctival and corneal epithelial cells which had some diagnostic significance, but we have since found these same bodies in other diseases, and we think they are probably nonspecific.

Dr. Heath: The second question Dr. Allen wishes to ask is: "Do you consider macrophages (Leber's cells) pathognomonic of trachoma?"

Dr. Thygeson: The Leber's cell is nothing but a large macrophage. They were in trachoma, certainly more numerous than in any other types of conjunctivitis studied, but they were also found in other infections. It seems to me that the presence of numerous Leber's cells in association with signs of cell necrosis and a predominance of lymphoblasts does indeed make a pathognomonic picture. I believe macrophages in other types of conjunctivitis tend to be definitely smaller than the Leber cell which is an extraordinarily large macrophage.

I am sure that the cells stem from the same origin, but there is an extraordinary size difference between macrophages from trachoma and those from other types of conjunctivitis.

Dr. Heath: Dr. Allen's third question is: "Will you discuss the importance of proper selection of the site for removal of material for cytologic study?"

Dr. Thygeson: It is a good rule to take cytologic material from the point of maximum disease intensity. Where exudate smears are taken, this is not of much significance, since most exudate accumulates in the inner canthus. Scrapings, however, are best taken from the site of maximum disease intensity.

When one is looking for suspected vitamin-A deficiency, it is important to recognize that the temporal limbus is the site most commonly affected in early deficiency. We would then take our scrapings from the outer temporal limbus area. This is the site where a Bitôt's spot is most commonly seen.

Dr. Heath: Dr. Donald J. Lyle asks the fourth question: "What are the best stains to use routinely in the laboratory investigation?"

Dr. Thygeson: I have used about a half-dozen different cytologic stains, and I definitely prefer the Giemsa stain. We fix our material in absolute methyl alcohol and then stain in dilute Giemsa solution (1 drop to 2 c.c. of neutral distilled water) for about an hour. We then pass the slide through two changes of 95-percent alcohol to remove the stain débris. This makes a

very satisfactory cytologic stain. Then, there is the Wright's stain, which is satisfactory and more rapid. I am sure there are two or three other stains which would work equally well, but I, personally, prefer the Giemsa.

DR. HEATH: Dr. V. C. Rombo asks: "Please discuss the differentiation between inclusion blennorrhea and trachoma."

DR. THYGESON: I think it is perfectly possible to make a cytologic differentation between these two diseases, especially in the adult. Both diseases have identical inclusion bodies; both diseases are characterized by a polymorphonuclear-cell exudate. It is the follicle cytology which makes the differentation possible. In inclusion conjunctivitis in the adult, the follicles show none of the degenerative changes characteristic of trachoma, and one gets the cytologic picture of the nontrachomatous follicle in contrast to the numerous cytologic changes so characteristic of trachoma.

I recognize that clinical differentiation is possible in most cases, but there are certainly occasional confusing cases in which cytologic study may be of value.

DR. HEATH: This question is from Dr. K. W. Ascher: "Did you observe, in cases of vitamin-A deficiency, syncytiumlike membranes of keratomized epithelial cells?"

DR. THYGESON: I may have seen those, but I did not recognize them as particularly characteristic. I am sorry; I really can't answer that question.

DR. EDWARD C. ELLETT (Memphis Tennessee): In speaking of the reaction to atropine, Dr. Thygeson made the distinction that the reaction to atropine was an allergic reaction and that to eserine was a toxic reaction. I should like to ask if he made any sensitivity tests for these two drugs in these conditions.

DR. THYGESON (closing): First of all, I noted that there was a very marked clinical difference between the conjunctivitis produced by these two drugs. The atropine reaction was typically a contact conjunctivitis and dermatitis, with widespread dermatitis of the eyelids; whereas, I never saw skin reactions in eserine catarrh. I recognize that these may well occur, but I have not seen them, personally. Secondly, I noted that the conjunctival reaction in atropine conjunctivitis was a papillary hypertrophy; whereas, in eserine conjunctivitis it was a follicular hypertrophy.

I made a number of tests, both by patch and by intradermal methods, and I was consistently able to obtain a positive patch test to atropine. Some were low grade, and others rather violent. However, I never succeeded in obtaining a patch test to eserine. I did not make serologic studies.

CONTRIBUTIONS TO THE SURGERY OF CONGENITAL CATARACT*

I. Modification of discission in the preschool age group

William F. Moncreiff, M.D.
Chicago

The present essay will attempt an analysis and evaluation of some important problems encountered in the surgery of the congenitally cataractous lens in the young child. It will present certain modifications of technique, devised and developed by me within the past two years, which are applicable to the preschool child, between the ages of one and six years, together with a report of three cases in which this method was employed.

Certain criteria may be stated to which any operation for congenital cataract in this early period of life, if it is to be adequately safe and efficient, should conform:

1. A single operative procedure should provide for rapid and complete absorption of the lens cortex and nucleus within four to eight weeks, without any but the most remote danger of severe reaction or increased tension. Thus, the need for a second operative procedure, or discission of a thin membrane, would be at least as infrequent as following extracapsular extraction of adult cataract, and correcting lenses could be prescribed within one to two months after operation, as in the case of the adult patient.

2. The incision in the limbus should be minimal, scarcely more than a puncture, so as to avoid prolapse or incarceration of the iris or other structures.

3. The operation should be limited to the lens, and should not involve the iris, the vitreous, or even the posterior capsule of the lens.

The author's procedure, omitting ordinary routine details of preoperative preparation and anesthesia, is briefly as follows. First of all, the most complete mydriasis (fig. 1) possible to attain by any or all means must be secured. There

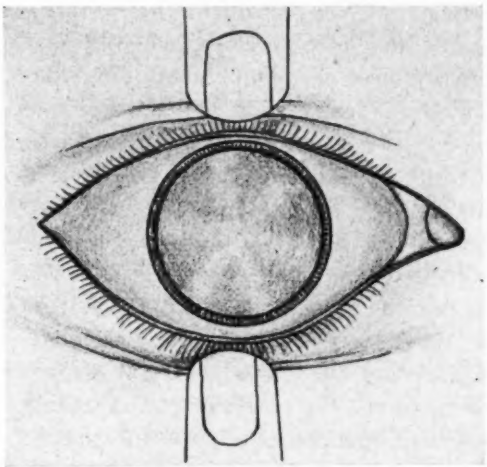

Fig. 1 (Moncreiff). Preoperative dilatation of the pupil.

are several reasons for this. They are:

The wider the pupil, the greater will be the expanse of the pupillary portion of the anterior chamber; thus, the more readily can lens substance enter the anterior chamber and remain there. Most important is the greater access thereby gained to the outlying portions of the anterior part of the lens approaching the equatorial region. Finally, there is the fact that the wider the pupil at the time of operation, the less the difficulty of maintaining a wide pupil after operation.

The knife-needle enters through the limbus at the temporal end of the hori-

* From the Departments of Ophthalmology of Cook County Hospital and of the College of Medicine, University of Illinois. Read before the Chicago Ophthalmological Society, March 18, 1946.

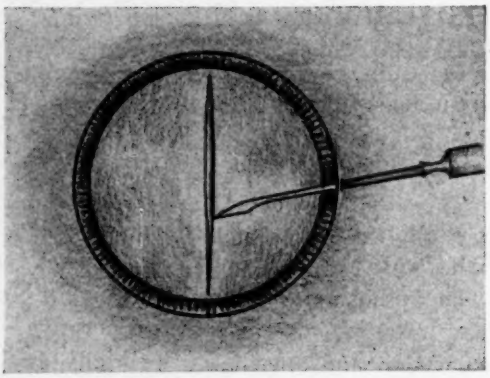

Fig. 2 (Moncreiff). Primary incision into the lens.

zontal meridian of the cornea, makes a vertical incision through the anterior capsule and into the cortex (fig. 2), and then multiple incisions in all directions through the lens capsule and anterior cortex (fig. 3), down to the nucleus, across the full expanse of the widely dilated pupil, until the anterior capsule and anterior cortex are literally reduced to shreds and small particles (fig. 4). When the nucleus appears and separates from the cortex, it is cut into several fragments (figs. 4 and 5), and a few light strokes are made into the posterior cortex, taking care not to puncture the posterior capsule, or to lose aqueous. With a properly made instrument, such as my model of the

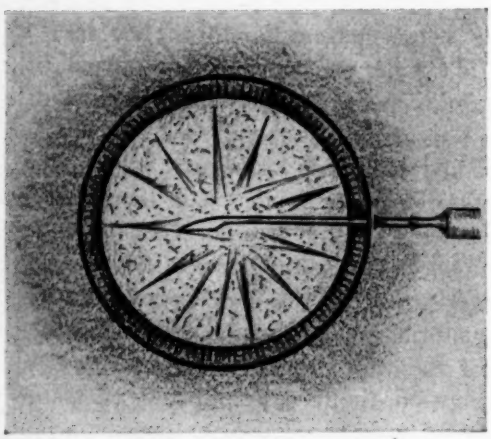

Fig. 3 (Moncreiff). Consecutive incisions into the lens.

Ziegler knife-needle, the operation can be carried to this point with little or no aqueous loss. The knife-needle is then withdrawn, permitting the escape of some aqueous. The tip (23 gauge) of the anterior-chamber irrigator (fig. 6) is then introduced through the knife-needle puncture, and fluid injected in the direction of the posterior capsule and toward the center of the pupil (fig. 5). This has the effect of removing cortical material from the remnants of the capsular sac and displacing it into the anterior chamber.

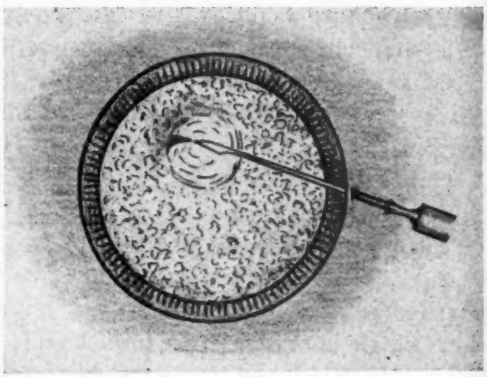

Fig. 4 (Moncreiff). Division of the lens nucleus.

Should it happen through accident or faulty technique that too much aqueous escapes before the multiple incisions of the lens are completed, the irrigator should be used to restore the anterior chamber, and another knife-needle of slightly larger size introduced through the same puncture to complete the division of the lens structure.

The essential feature of postoperative care is to maintain the wide dilatation of the pupil, which is much more readily done after this type of operation than after the conventional discission. It need scarcely be said that in addition to atropine ointments of whatever dosage can be borne by the individual patient, great reliance is placed, both pre- and postoperatively, on epinephrine-type drugs which

are powerful stimulants of the dilator pupillae, particularly neosynephrin in a 10-percent solution or emulsion.

From May 1, 1944, to May 9, 1945, the operative procedure just described was employed in six eyes of three patients, as follows.

Case reports

Case 1. J. V., a colored girl, aged 14 months, was first examined on April 20, 1944. Her history told of white pupils being noted at birth. The child had always been poorly developed physically. A physical survey revealed general under-

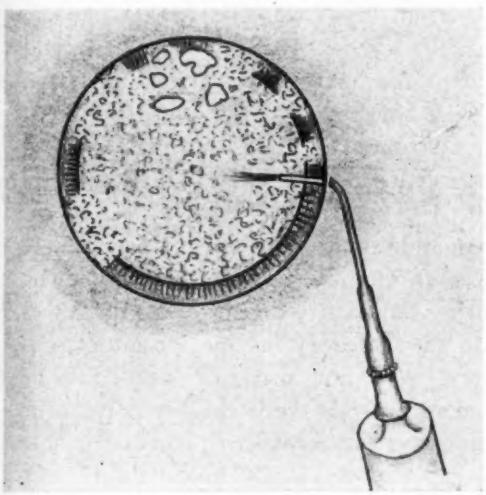

Fig. 5 (Moncreiff). Introduction of irrigator tip and displacement of lens fragments into anterior chamber.

nourishment and underdevelopment, with congenital heart disease. Body weight was only 18 lbs. The eyes exhibited asymmetrical pendulum nystagmoid movements. Pupillary reaction to light was normal; the irides were dark brown; the dull-white lenses were completely opaque; there was no fundus reflex even through the periphery, with widely dilated pupils.

Operative procedure on both eyes, under general anesthesia, was undertaken on April 26, 1944. In this case, a small, narrow Graefe knife was used for the primary puncture at the limbus, and the incision of the anterior capsule and cortex of the lens. The knife-needle was then substituted for the remainder of the lens incisions. The irrigator tip was then introduced, and the fragments of lens sub-

Fig. 6 (Moncreiff). Goldstein anterior-chamber irrigator.

stance displaced into the anterior chamber by injecting physiologic saline solution.

The postoperative course was characterized by a minimum of inflammatory reaction; there was only the faintest bulbar injection. During the first week, the anterior chamber of each eye was entirely filled with fragments of lens substance. Wide dilatation of the pupils was maintained without much difficulty. At the end of four weeks, after gradual absorption, the fundus reflex was clear throughout the pupil of each eye, and only a thin transparent membrane spanned the pupillary space, fringed along the pupillary margins with minute remnants of lens substance.

On June 26, 1944, skiascopy at 0.5 meter showed: R.E., +12.00; L.E., +11.00. No adequate record of visual acuity could be made. The lenses prescribed (according to the skiascopic findings) were: R.E., + 10.00; L.E., + 9.00

Case 2. B. J. A., colored girl, aged 2½ years, when first examined on November 25, 1944, had a history of being a premature infant with a birth weight of 4 lbs., 11 oz. White pupils were noted at birth. A physical survey revealed nothing especially noteworthy in the general condition. The eyes displayed slow pendulum

nystagmoid movements. Pupillary reaction to light was normal; the irides were dark brown; each lens was completely opaque, as in case 1.

Operative procedure on both eyes, under general anesthesia, was undertaken on November 29, 1944. The details of the operative procedure were substantially the same as in case 1, except that no Graefe knife was used, the knife-needle being used entirely for the discission part of the procedure.

The postoperative course was similar to that in case 1, except that at the end of two weeks the right pupil was entirely clear of lens substance, and the left pupil was almost clear.

This patient was discharged from the hospital two weeks after operation. Since then, coöperation as to return visits has been so poor that no data on the refraction and visual acuity have, as yet, been obtained.

Case 3. R. H., a colored boy, aged five years, was first examined on May 2, 1945. His history included cataractous changes noted in the crystalline lens of each eye at birth by the attending physician. A physical survey revealed his general condition to be normal. The visual acuity of each eye was limited to counting fingers at 3 feet. There was no nystagmus nor nystagmoid movement. In each lens, there was fairly dense central lamellar (or zonular) opacity, apparently about 6 mm. in diameter and of a stellate pattern, lying in the periphery of the fetal nucleus and surrounding layers. There were many fine, white dots of opacity throughout the periphery of each lens. The irides were dark brown. No lesions were found in the portions of the fundi which could be seen through the periphery of the lenses with widely dilated pupils.

Operative procedure on both eyes, under general anesthesia, was undertaken on May 9, 1945, using the same technique as in case 2. In the right eye, the nucleus was not divided but in the left eye, the nucleus was cut into three fragments.

The postoperative course was characterized, as in the other two cases, by a very slight degree of bulbar injection. The nuclear portion of each lens completely disappeared within a month, by June 4, 1945. The pupillary zone of the right eye was entirely clear of lens material, and the corrected vision of the right eye at this time was 0.8, but not until July 2, 1945, almost two months after operation, was the pupil of the left eye clear.

On June 16, 1945, the refraction of the right eye was: +12D. sph. ⌒ +2.50D. cyl. ax. 105° = 0.8 (illit.); and that of the left eye was: +11.75D. sph. ⌒ +2.50D. cyl. ax. 90° = 0.8 (illit.). On October 8, 1945, corrected vision was: R.E., 0.8+2 (illit.); L.E., 0.8+3 (illit.).

In addition to these three patients, there were three other patients, operated on during the past two years, who do not fit into this category, as the irrigator technique was not used or needed. The reasons for this were: In one patient the lenses were hypermature; consisting only of capsule containing milky fluid; and, each of the other two patients was under one year of age, at which age the lens structure is so delicate that the entire procedure can easily be accomplished with the knife-needle alone, and without the use of the anterior-chamber irrigator.

Reports in the literature

A complete review of the literature is not contemplated in this paper, and reference will be made to only a few publications related to points upon which it is desired to place special emphasis.

Prevention would, of course, be the ideal method of solving the problem of congenital cataract. In so far as the developmental forms are concerned, there are numerous articles in the literature de-

voted to the role of heredity, some complete with extensive and complicated family trees, all of which are of great scientific and academic interest. It may be that in the dim and distant future, by virtue of such studies, the elimination of all hereditary and developmental cataracts will be achieved.

Be that as it may, it would seem that the *surgery* of congenital cataract has been, for the past 25 years, a greatly neglected subject, as indicated by the fact that since Ziegler's[1] publication, in 1921, of his V-shaped or through and through discission of the lens, nothing actually new in principle has been published on this subject, so far as I have been able to discover.

During this 25-year period, although only a relatively few papers dealing with surgical procedures for congenital cataract have appeared, and these devoid of any real solution of the unsolved difficulties, there has been an avalanche of publications concerning adult or so-called senile cataract, most of which lay particular emphasis on surgical procedures. During this period, the modern techniques of intracapsular extraction have been evolved and popularized, and important improvements (in the extracapsular operation), as well as various safety measures for lens extraction in the adult patient, have been devised and rather generally adopted. This discrepancy between the attention accorded the surgery of congenital as compared to that given adult cataracts would not be particularly remarkable were it not for the fact that, previous to these developments of the past 25 years, the results of extracapsular lens extraction in the adult patient, in skilled hands, were already better than the results of any procedure or combination of procedures for congenital cataract. The one possible exception to this assertion is the Ziegler operation to which there are important basic objections, as will be shown later. Various reports of surgical and visual results in congenital cataract have been made. Usually these reports have been characterized by too high a percentage of surgical complications and failures, entirely aside from the well-known incidence of amblyopia, nystagmus, and various congenital eye defects other than cataract which, of course, ought to be sharply distinguished from the surgical failures.

The most recent contribution of this kind is that of Falls,[2] whose report of the results in 131 cases at the University of Michigan between 1925 and 1942 will serve as an example. In this series, the number of eyes operated on was 223, and the number of operations 510, plus 14 others which complications necessitated. There were 413 discissions and 64 linear extractions, 60 of which followed discission and were done for the removal of swelling cortical material. In 19 of these eyes, there was increased tension or secondary glaucoma which, in 9 cases, persisted after linear extraction. Falls does not mention in his paper whether or not the Ziegler type of discission was used in any of these cases. However, in a personal communication Dr. Falls said that the Ziegler operation was not done.

Among other supplementary operations employed to relieve complications were: extraction of secondary lens membrane (5), iridocapsulotomy (4), iridectomy for prolapsed iris (4), excision of anterior synechia (2), cyclodialysis (4), Elliot trephine and LaGrange sclerectomy (1 each), and one enucleation. The greatest number of discissions performed on any one eye was six, but the number of eyes on which more than two, or more than three, discissions were performed is not stated. These surgical facts would appear to be more significant in evaluating the efficiency of the surgical methods used than are the visual results reported, since, unfortunately, no selective informa-

tion is given as to which visual defects were chargeable to surgical complications and failures, and which to amblyopia and to congenital defects other than cataract. Postoperatively, 53.5 percent of the 233 eyes attained corrected vision of 6/30 or better; whereas, 16.8 percent were industrially blind, and in 20.6 percent the visual acuity was indeterminate. An attempt is made to draw conclusions as to the relative efficiency of discission alone and discission followed by linear extraction, by citing that only 27.1 percent of the group treated by discission achieved vision of 6/12 or better, compared with 54.9 percent of the group in which discission was followed by linear extraction. However, in comparing acuity for near vision, the advantage, although slight, was with the group treated by discission only, to the extent that 27.7 percent (as compared to 25.4 percent) could read Jaeger 1 to 3.

The final conclusion offered is that "Surgical intervention in early life is hazardous, as shown by the fact that a high percentage of complications and 33 percent of the total failures occurred in the age group under two years." It should be noted, however, that this group was a small minority of the whole series, only 17.5 percent, or 23 patients. The present author doubts the validity of the above conclusion, and considers that, at best, it can apply only to the methods used and to the operators who used them. If any considerable number of the operations on patients under two years of age were done by beginners, then there is the possible factor of a higher proportion of complications in this age group due to insufficiently skilled operators.

In Falls' series, discission of the "lens capsule" was stated to be the safest technique for children under two years of age. This notion about limiting the operation to the capsule (without including the cortex and nucleus) will be commented upon later. Falls also makes the suggestion that, when the cataractous condition is complete and bilateral, six months of age should be chosen as the time for operation on the first eye, and two years of age for that on the second eye. This suggestion is faulty on both counts.

First, very few, if any, infants will be found, especially those with brown irides, in whom sufficient pupillary dilatation can be obtained at six months to make the operation expedient at so early an age. There are a few at eight months of age, and the proportion increases rapidly until, at one year and older, there are few which present any serious difficulty.

Secondly, if a correcting lens is applied and good vision develops in the first eye, the second eye will have more than a year in which to become amblyopic. A year should be ample time in many cases for the amblyopia to become so fixed as to constitute a troublesome problem in itself. In brief, if both eyes require operation, both should be done at once, barring some definite contraindication.

Let us now examine the prospects of success for the conventional surgical procedures for congenital cataract in terms of the criteria stated in the introductory paragraphs of this article. Under the first heading—a single operative procedure should provide for the rapid and complete absorption of the lens cortex and nucleus, within four to eight weeks—what is the record of ordinary discission? Falls' reference to discission of the "lens capsule" as the safest procedure in the child under two years of age expresses the false conservatism and timidity of many operators of the past, and doubtless some of the present day. If the incision is made with the intention of limiting it to the anterior capsule of the lens, the absorption of the lens substance, in the average case, will be very slow, and one such operation will rarely reduce the lens to a

membrane thin enough to be dealt with definitively and finally by a single subsequent operation. After such an inadequate primary operation, there is usually great difficulty in maintaining a widely dilated pupil, so that the iris itself becomes an obstacle preventing access of aqueous to the lens substance. The consequence is inadequate absorption of the lens substance and, after one or more such procedures, a tough fibrotic mass may result so that no amount of subsequent discission can succeed in obtaining a clear pupil. Uveitis, increased tension, and secondary glaucoma should rarely occur under six years of age with any type of discission, since up to this age the lens is very soft and its nucleus small and not hard. Such young eyes usually react favorably. There are, nevertheless, certain factors which tend to produce these complications and which, at older ages, become very formidable. Faulty technique, in the sense that there is pulling or traction on the zonule and ciliary processes instead of clean cutting into the lens, can cause a marked rise in tension, even within a few hours, and this is usually accompanied or followed by iridocyclitis. There is, of course, no excuse for this faulty technique in any type of discission. The swelling of large masses of lens substance, if located behind the iris and toward the chamber angle, is likely to produce anterior uveitis and increased tension, especially in older children and adolescents.

The author's method attempts to avoid these complications and to insure rapid absorption of lens substance by dividing the lens cortex and nucleus into as many and as small fragments as possible and then by displacing these fragments into the anterior chamber. The lens particles are too large to affect the osmotic equilibrium, so they cannot elevate the tension by that mechanism; and they are too small to cause a rise of tension by mechanical swelling, particularly since they are away from the chamber angle and in front of the iris. What of the masses of flocculent lens cortex that cannot be divided into small fragments? There is no question that soft lenses vary in their physical properties, and this condition may be encountered in some cases. However, these masses can easily be displaced into the anterior chamber by the use of the irrigator; the only difficulty which they cause is slower absorption.

The criterion set forth under the second heading of the introduction of this article—that the limbal incision should be limited to the puncture of a knife needle—rules out all forms of so-called linear extraction, in which there is an ever present danger of iris prolapse, even in the Barkan[3] method of using a keratome incision in the clear cornea. In the case of children under six years of age, and perhaps in some a bit older, there should as a rule be no occasion which requires the extraction of lens substance after discission by the method presented in this paper. However, for discission alone, of whatever type, there is an upper age limit, whether it be 10 or 20 years, and beyond this age limit some method of extracting most of the lens substance will be necessary. The author has in mind a type of procedure for these older patients, with positive safeguards against iris prolapse, which, when sufficiently tried out, will become the basis of a subsequent communication.

The third criterion, stated in the introductory paragraphs, bears on the question of optical iridectomy on the one hand, and the Ziegler operation on the other. Optical iridectomy, such as might be employed for the varieties of congenital cataract with centrally located opacities, requires little comment, since it has been virtually abandoned for two obvious reasons: (1) the optical imperfection of the peripheral and even the paracentral

portions of the lens and cornea; and (2) the importance of the optical and cosmetic functions of the intact pupil, especially in young individuals. On both counts, aphakia with a round pupil is preferable.

In discussing the Ziegler operation, one enters upon what may prove to be the most controversial phase of this entire subject. It is conceded at once that undoubtedly many good, immediate results have been obtained by this method, with a single operation and in record time. (The same can be said, however, for the obsolete couching operation.)

The fundamental question is: What is the future of eyes operated on by the Ziegler method, especially in the later years of the patient's life, when the operating surgeon has long since passed from the scene? Can we really traumatize the vitreous with impunity, especially in the eye of the infant or young child?

This is an important question, and especially so in view of the incomplete state of our knowledge of the pathogenesis of retinal detachment, glaucoma, and various other intraocular disorders. While I have witnesed no late complications in such cases, for the simple reason that I have had no occasion to observe any adult or other patient in whom the Ziegler operation had been done, I take this opportunity to invite ophthalmic surgeons to report any data they may have which bears on this point.

For those who like to attempt to settle vexatious questions by citing authorities, reference will now be made to some comments on the Ziegler operation by several well-known ophthalmologists. The following statements were made at meetings of the Academy. One occasion was in 1926 during discussion of a paper by Dean;[4] another was in 1928 when a paper by Wilder[5] was being discussed. The Ziegler operation was disapproved by Dean, Greenwood, Lancaster, and Wilder, all of whom stated that they were opposed to any traumatizing of the vitreous. Dean, in particular, questioned the validity of Ziegler's claim that his operation is never followed by increased tension. Benedict and Wiener, on the other hand, endorsed the Ziegler operation and saw no harm in the trauma to the vitreous incident to it. Benedict remarked that he could not see what difference it made whether the vitreous was incised at the first operation or the last.

Some of these discussants gave no particularly cogent reason why they approved or disapproved the Ziegler operation and its attendant trauma to the vitreous. Lancaster, however, in referring to one of his patients in whom an acute rise of tension followed the Ziegler operation and made it necessary to evacuate the lens material, remarked that the vitreous escaped more easily than the lens substance. Since that experience, he has not used the Ziegler procedure. Wilder believed that a marked delay in the absorption of the lens occurred when vitreous was allowed to mix with lens substance, as in the Ziegler operation. Ziegler himself, in his original report in 1921, stated that, while it was undesirable to "stir up" the vitreous, there would be no harm in making a clean cut incision into it with a sharp knife.

Nevertheless, it is an established fact that the vitreous breaks down as a result of direct trauma, to which it is very sensitive. Duke-Elder[6] states: "The vitreous is a homogeneous gel in a very unstable state of dynamic equilibrium, the consistency of which can be readily destroy by the slightest mechanical insult." E. Redslob[7], who is internationally known for his work on the vitreous, in discussing the pathologic changes in the vitreous which arise solely from disturbance of the vitreous gel, states that a mechanical lesion, or trauma, is sufficient to cause a separation between the framework and

the liquid phase. In discussing disorganization of the vitreous by upset of the colloidal equilibrium, he further states, under the heading of injuries of the eyeball: "Contusion may disorganize the vitreous structure. The same effect is produced by perforating wounds. In such cases, the bundles of agglutinated fibres converge toward the wound. This disorganization is readily observed when, following an accident or an operation, the vitreous body is extruded into the anterior chamber." As the eye pathologist can testify, the safest place for the vitreous is its normal habitat, and it does not stay there if one sticks a knife into it by way of the anterior chamber. No attempt will be made here to catalogue or describe the pathologic processes, some leading to secondary glaucoma, which may result from the prolapse of vitreous into the anterior chamber, a result virtually inherent in the Ziegler operation. It is sufficient to say that, in so far as cell growth plays a part in these processes, it is much more active in the young child than in the mature adult.

The idea that the vitreous must necessarily be incised in the discission of a thin membrane remaining after discission of the lens, as implied by Benedict in his statement already cited, is no more universally correct than it would be for discission of the thin membrane after extracapsular lens extraction. In brief, the posterior capsule of the lens is not necessarily in contact with the vitreous since, in most eyes, a true retrolental space exists. This space is still present if the posterior capsule has been preserved. By careful technique one can often incise the membrane without puncturing or incising the vitreous.

Summary and Conclusions

The surgical problems encountered in congenital cataract, especially in patients between the ages of one and six years, have been discussed, and it has been proposed that an ideal method, contrary to most of the previously used methods, should obtain complete absorption of the lens nucleus and cortex, in the pupillary zone, within four to eight weeks, with a single operative procedure, and with only slight danger of undue reaction or increased tension. Furthermore, special emphasis has been placed on the importance of preoperative, maximal dilatation of the pupil, and upon the danger of incising the vitreous, either by accident or by design, as in the Ziegler operation. Linear extraction in this age group is disparaged, principally because of the danger of iris prolapse, although it is recognized that at later ages some form of extraction will be necessary. It is planned to deal with this subject in a subsequent paper.

The author's method of modified discission, in which the lens cortex and nucleus are divided into small fragments and these are then displaced, by means of the irrigator, from the capsular sac into the anterior chamber is proposed as an approach to the ideal operative procedure for the age group cited. Although, to date, the method has only been applied in six eyes of three patients, the surgical results have been so uniformly good that it seems worth while to publish it. It is hoped that this method will be tried out by many operators in a large number of cases, for this is the only means by which a final evaluation of its true worth can be made.

Both a priori and judging from experience, there seems no need to postpone operation for congenital cataract beyond the age of two years, as a general policy; or, in bilateral cases, to interpose an artificial interval between operation on the first and second eyes.

58 East Washington Street (2).

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ELECTROENCEPHALOGRAPHY AND OPHTHALMOLOGY*

ALSTON CALLAHAN, M.D.†
Birmingham, Alabama
AND
FREDRICK C. REDLICH, M.D.‡
New Haven, Connecticut

History

Electroencephalography is the technique of recording the electrical beat of the brain. The study of the electrical activity of the brain began in 1874 when Caton, an English scientist, discovered evidences of electrical fluctuations in the brain of living animals.[13] In 1902 and 1907, Hans Berger, father of modern electroencephalography, recorded spontaneous rhythmical fluctuations in the electrical potentials from the brains of animals and, in 1930, was successful in recording evidence of the electrical activity of the human brain.[7] He showed that normally the beat of the brain appears as a mixture of more or less sinusoidal fluctuation in voltage with a frequency of from 1 to 60 per second and that the most commonly recorded rhythm has a frequency of approximately 10 per second in normal adults (fig. 1). Berger proved that this electric rhythm came from the cortex and called the record the electroencephalogram.

Gibbs and Gibbs,[15, 16 17, 18, 19] and William Lennox[16, 28] have been the most prominent American investigators in this field, and their research has made this method of investigation useful in clinical neurology. Their work was greatly aided by the construction of a reliable and sturdy instrument by Grass, using magnetic inkwriters for the recording of the brain waves. Within the past 10 years, over 2,000 publications and some exhausting treatises on the subject of electroencephalography have been written. The outstanding reference is Gibbs and Gibbs's "Atlas of Electroencephalography,"[15] which deals authoritatively with all aspects of clinical electroencephalography. Besides the numerous research publications, there are other excellent general references, such as Lindsley's,[31] which stresses the physiologic and psy-

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† Department of Ophthalmology, Medical College of Alabama.

‡ Department of Psychiatry, Yale Medical School.

chologic aspects; Jasper's,[22, 23] with its consideration of the epilepsy problem; and Hoefer's,[21] Williams and Gibbs's[50] on the use of electroencephalography in the diagnosis and prognosis of head injury. The most important research on the localization of cerebral lesions was done by Walter,[49] and by Gibbs, Wegner, and Munro.[18, 19] Berger's original articles remain the basic source of reference.

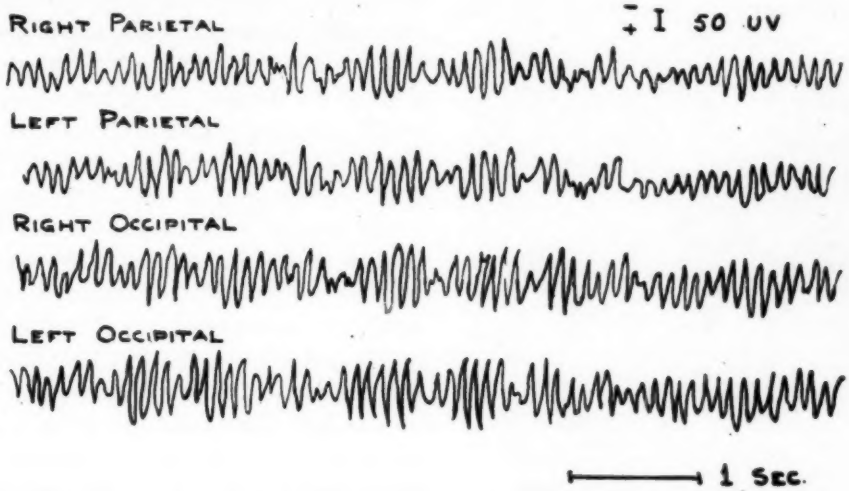

Fig. 1 (Callahan and Redlich). Normal electrical rhythm of the brain. Tracings from four areas are made simultaneously. Monopolar lead.

PHYSIOLOGY

The electroencephalogram records electrical brain activity from the surface of the scalp, just as the electrocardiogram records that of the heart from the chest wall. Voltage of the former is much smaller, however, being approximately one hundredth of that of the heart. Gibbs and Gibbs point to the similarity of the electrical rhythm of the cortex and the activity of the respiratory center; for example, respiration and brain waves (although 60 times faster than respiratory frequency) are both slowed considerably by sleep, sedatives, and low carbon-dioxide mixtures. The beating of the brain becomes faster and shallower with stimulation, and by attention. It becomes faster with increasing age. Electroencephalograms (EEG) vary considerably from one person to another and are not always constant in the same person.

Some confusion exists in EEG nomenclature, and many investigators now avoid, wherever possible, the original designation of alpha, beta, or gamma waves. Gibbs has suggested a classification of waves based on their frequency, amplitude, and appearance. Normal frequencies in adults are from 8½ to 12 per second; pathologic brain waves are classified as slow, very slow, fast, very fast, and paroxysmal, the latter occurring in a large percentage of convulsive disorders. The amplitude varies from 5 to 150 microvolts, the normal limits ranging from 10 to 50. The appearance is usually sinusoidal, but may be spike-like, or wave and spike, and similar combinations.

Like the electrocardiogram, the maximum diagnostic and prognostic value of the EEG is attained when it is combined with other types of clinical and laboratory examinations.

Clinical application

Electroencephalography has become useful in neurologic diagnosis and has found widespread application. Its greatest usefulness lies in the following fields: (1) the diagnosis of convulsive disorders;[45] (2) the diagnosis and prognosis of head injuries, particularly those accompanied by convulsive seizures;[21] (3) the diagnosis and localization of expanding intracranial lesions, such as tumors, subdural hematomas, and brain abscesses;[18,40] (4) the diagnosis of narcolepsy, of some types of encephalitis, and of the residuals of meningitis;[45] (5) it may be helpful in the diagnosis of diffuse, inflammatory, or degenerative conditions of the brain, in some organic psychoses, and it eventually may be of help in the diagnosis of personality disorders.[31]

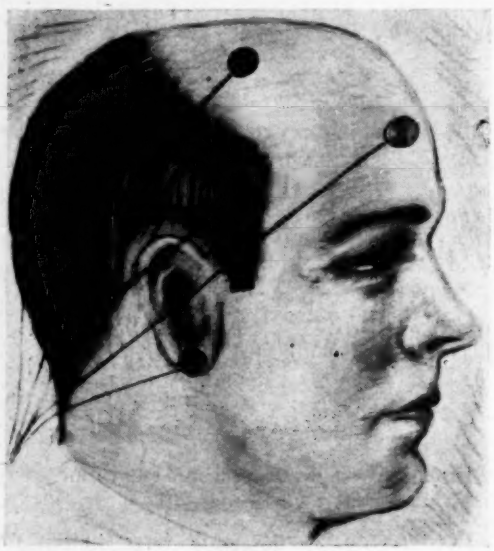

Fig. 2 (Callahan and Redlich). Position of leads for recording of electrical discharges from frontal, parietal, temporal, and occipital lobes. The lead on the ear is the "ground."

Technique

Small solder electrodes are affixed directly to the scalp without cutting or shaving the hair (fig. 2). The standard arrangement adopted in most laboratories, including Army and Navy installations, is to use eight electrodes, with two ground electrodes attached to the ears (U. S. Army T.B. Med. Bulletin No. 74). For localization, ground electrodes are usually dispensed with, and the brain waves are recorded by the bipolar method. The electric current passes by conduction from the cortex through the skull and scalp to the solder electrodes, whence it goes to the switch box and to the amplifying units. The voltage of the brain waves is amplified about 10 million times, and the fluctuation is recorded on paper tape which moves past a recording point at a constant rate. Each lead is recorded separately, and on standard models, the brain waves from four to six channels may be recorded simultaneously. It requires 20 to 30 minutes to affix the electrodes, and the patient is instructed to lie on a cot or sit in a comfortable chair in a room properly screened from outside electrical interference. An EEG can usually be recorded in 30 minutes. We have employed the standard eight leads in studying certain eye problems, and in others we have affixed an electrode to each supraorbital region and (one) to each infraorbital region and used the bipolar method of recording.

Application of electroencephalography to ophthalmology

The aforementioned investigations are reported in special publications such as those of general biology, physiology, psychology, neurology, and psychiatry. Some have appeared in the general medical journals but very few in the ophthalmic literature.

Several problems of primary interest to ophthalmologists are: (1) local electrical discharges following eye opening and closing and eye movements; (2) effect of visual stimulation and eye opening and closing on the occipital electroencephalogram; (3) diagnosis of false

(hysterical or malingered) blindness; (4) localization of cerebral lesions with visual defects.

Local electrical discharges following eye openings and closing, and eye movements

It has long been known that a constant electric-potential difference is present in the intact or enucleated eye, and that the cornea is always positive and the posterior half of the globe is negative. Adler[1] compares this to the demarcation current in the muscle of a frog's leg, and Duke-Elder[14] believes that this difference in electrical potential is the registration of the difference in potentials which exist on either side of the membranes through which the intraocular fluid dialyzes. Miles[36, 37, 38] has shown that the steady potential from the eyeball can be measured by making use of the eye's motility, electrodes being applied above, below, and lateral to the orbits. The measurable ocular polarity potential of the human eye *in situ* is in the order of 1.0 millivolt when the eye rotates laterally 30 degrees from the primary line of regard; the range between supposedly normal subjects is from about 0.3 to 2.5 millivolts. Mowrer, Ruch, and Miller[39] recorded potentials with a galvanometer, and since they were able to abolish them by destruction of the retina of rabbits with hydrocholoric acid, considered them due to the corneoretinal potential. Redlich, Callahan, and Schmetje[43] have examined 40 patients (table 1) with various injuries and diseases of the eye, recording the electric potentials from supraorbital and infraorbital leads with the electroencephalographic apparatus. (These fluctuations are from the eye potential, and are not brain waves.)

Eye opening and closing, or blinking. The blink reflex is a sudden, firm closure of the lids, in which the superior rectus contracts to pull the eye up, the levator relaxes, and the orbicularis contracts firmly to close the lids.

In patients with normal visual apparatus, blinking of the eye caused 2- to 4-per-second sinusoidal waves of 60 to 150 microvoltage, seen best in the frontal leads, occasionally in the other leads.

TABLE 1

Types and distribution of ocular lesions used for experiment

Unilateral traumatic anophthalmos (operative enucleation)	16
Unilateral traumatic anophthalmos (operative evisceration)	10
Bilateral enucleation	1
Bilateral evisceration	1
Unilateral complete destruction of orbit, eyelids, and anophthalmos	2
Primary peripheral facial paralysis with lagophthalmos	2
Unilateral optic atrophy with amaurosis	2
Unilateral avulsion of the optic nerve	2
Unilateral traumatic chorioretinitis	2
Unilateral optic neuritis, cause unknown	2
Total	40

They are regular, smooth, and differ radically in their appearance from muscle-potential discharges, which result from action of the palpebral, orbicular, frontal, and temporal musculature.

In patients with unilateral anophthalmos (enucleations and eviscerations), the potential from the anophthalmic side was either very weak or absent (fig. 3). When present, it is probably due to the spread of potentials from the normal side. No blink waves were seen in a case of bilateral evisceration or in a case of bilateral enucleation.

In patients with unilateral optic neuritis and extensive chorioretinitis, the potentials following blinking were of a similar nature and order from both affected and normal eyes. Normal blink waves were obtained in the complete absence of light perception.

Eye movements. Lateral and vertical spontaneous and voluntary eye move-

ments result in only small deflections as recorded on the electroencephalogram, and they are identical with those obtained when the eyeball is moved passively with a forceps. In patients with a unilateral evisceration or enucleation, no potentials not due to muscle currents. This finding is in corroboration of the work of Miles and Mowrer, Ruch and Miller.

In addition to the steady potential of the eye, an action current is formed when light falls on the retina. This current

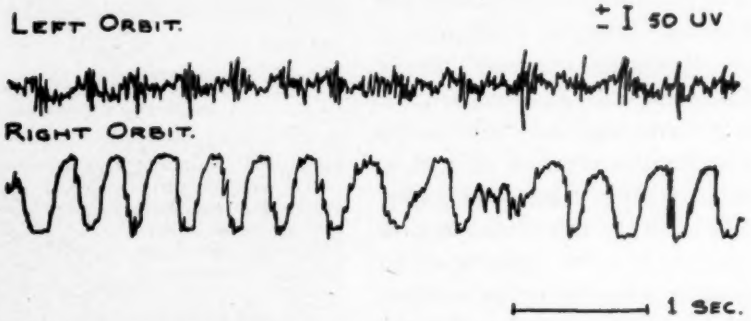

Fig. 3 (Callahan and Redlich). Patient 446; left eye has been eviscerated. Leads were placed at the orbital rim of each side, and the patient was instructed to blink eyelids rapidly. The large sinusoidal waves as recorded from the right orbit are the so-called "blink waves." This finding suggests that the retina is essential for movement discharges.

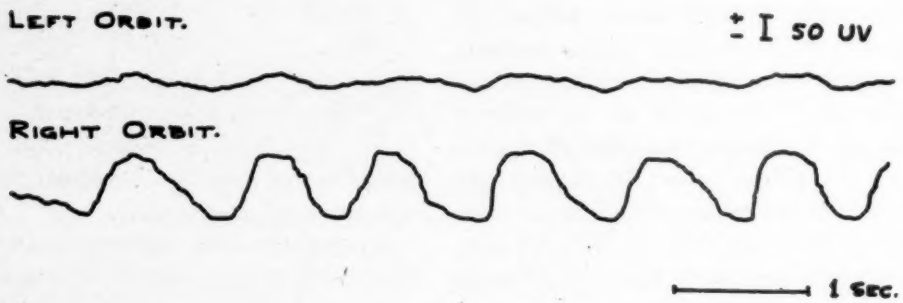

Fig. 4 (Callahan and Redlich). Patient 597; left eye has been eviscerated. Leads placed at orbital rim of each side, and patient instructed to roll his eyes about. This finding also suggests that the retina is essential for movement discharges.

were observed on the injured side after active or passive eye movements (fig. 4). In patients with optic neuritis and chorioretinitis, there were normal potentials after eye movements. Studies of the electrical component of nystagmus have been made but no typical electrical phenomena could be recorded on the electroencephalogram upon eliciting optokinetic nystagmus in normal eyes.

Therefore, it seems quite certain that the electrical potentials which occur are due to the corneoretinal potential, and are can be registered in the form of an electroretinogram, which shows the short latent period after the stimulus and then a short negative phase followed by the sharp, large, positive deflection that subsides slightly and is succeeded by a much slower, longer, positive phase. The optic nerve, although a part of the central nervous system, responds to stimulation remarkably like a sensory nerve. The latent period after stimulation of light is considerably longer than the latent period of retinal current, and Adrian found that

the latent period could be considerably shortened by increasing the size of the retinal image, which implies that the various points in the retina are linked together. There has been considerable scientific interest in the phenomenon of the eye's photoelectric response to light, but in none of our studies did we record electroretinograms, and it is mentioned only as a preliminary to consideration of the following sections, which deal with the resultant effects upon the cerebral cortex of the action of light upon the retina.

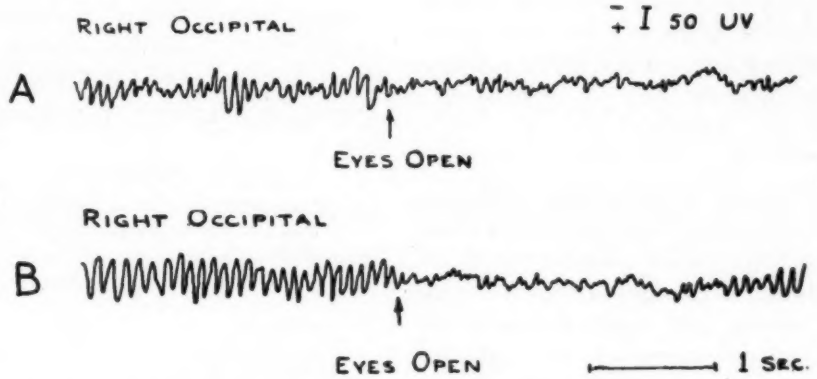

Fig. 5 (Callahan and Redlich). Patient 869; no abnormality of visual mechanism. A, EEG tracing in daylight. B, EEG tracing in darkness are identical except for quicker return of original (closed-eye) rhythm in darkness. Monopolar lead.

Effect of visual stimulation on the occipital rhythm

(1) Single visual stimuli, by eye opening and closing. Berger[7, 8] reported that visual stimulation by the opening of the eyes in a lighted room altered the occipital-brain rhythm, but that opening of the eyes in a darkened room did not change it.

Jasper and Cruikshank[22,23] found an increase in frequency of the brain waves after opening the eyes in a lighted room but mentioned that sometimes opening of the eyes in the dark produced similar results. Williams[51] showed that not only visual stimulation but other procedures which stimulate the subject result in a change of the occipital rhythm.

Redlich, Callahan, and Mendelsohn[44] found, in a study of 30 patients with normal brain waves, that opening the eyes in complete darkness or in a lighted room usually had about the same effect, although the rhythm returned to the prestimulation rate more quickly in the dark than when the eye was opened in daylight (fig. 5). This suggests the existence of additional factors besides the stimulus of light on the retina in the production of altered occipital rhythm. It is unlikely that the factor of attention alone accounts for this, for only 9 of 42 patients showed changes when, with eyes closed, they were asked to visualize some person or object.[20]

Changes of the occipital rhythm after visual stimulation caused by the opening and closing of eyes in daylight were studied in 100 patients with normal vision, 32 patients with unilateral blindness, 3 blind patients, and 9 patients with homonyous hemianopia.

In 10 of 11 patients with unilateral blindness (enucleation) and with normal electroencephalographic rhythm, opening of the lid of the anophthalmic side had about the same effect on the occipital

rhythm as opening the eye on the normal side.

No changes in the occipital rhythm after opening the eye were noted in three patients with normal alpha rhythm, who were blind because of bilateral evisceration or enucleation.

We attempted to discover some characteristic EEG finding in amblyopia ex anopsia. In 10 such patients whose records we studied, the occipital rhythm was normal, and there was no difference in the occipital waves when the normal and when the amblyopic eye was stimulated in turn by a weak light, a bright light, by reading, and by reviewing a picture.

(2) Repeated visual stimuli. Although other investigators have previously noted that repetitive photic stimulation of the retina induced changes of the occipital waves, Adrian and Matthews[2] were the first to use photic driving to modify the normal occipital rhythm. They found that photic driving in man was most apparent when the rate of photic stimulation was between 10 and 20 cycles per second. Synchronous records of the occipital and temporal alpha rythm show that the occipital alpha waves can thus be made to follow a flickering light; whereas, the frontal alpha waves retain their original rhythm and are unaffected by it.

Bartley,[3,4,5] Bartley and Bishop,[6,9] and Bishop and O'Leary[10,11,40] showed that response to controlled stimulation of the retina or the optic nerve emerges in the cortical record as a quite definite wave complex. To insure the most condensed response by eliminating the complications due to repeated sense-cell discharge, in the experiments of Bishop and O'Leary the optic nerve was stimulated directly. They found that the stimulus drives the cortex by instituting a series of waves which are similar to alpha waves but out of phase with the preëxisting alpha waves and sometimes entirely supplanting them. It is, therefore, possible that the peripherally induced cortical activity and the preexisting waves occupy the same group of cells in the same way and that direct stimulation may initiate an alpha rhythm.

Use of the electroencephalogram in distinguishing true from false blindness

The fact that most individuals with normal visual systems will show EEG changes upon opening the eyes has led Lemere[27] to conclude (unjustifiably) that it is a method of differentiating true from false blindess with certainty.

TABLE 2

CHANGES IN THE OCCIPITAL RHYTHM FOLLOWING OPENING OF THE EYES IN DAYLIGHT

	Amplitude	Frequency
No change	12	20*
Slight change	16	51
Moderate change	31	10
Marked change	41	19

* All 12 of the cases showing no change in amplitude are in this group of 20.

As stated previously, the effect on occipital rhythm of visual stimulation caused by opening and closing the eyes in daylight were studied in 100 patients with normal vision. The findings are shown in Table 2. From these, it is evident that most persons with normal occipital rhythm and with normal visual apparatus do show changes in the occipital rhythm when the eye is stimulated by light; but it is also evident that there are exceptions (fig. 6). Therefore, the effect on the EEG caused by opening and closing the eyes does not permit a consistently valid differentiation between true and false (hysterical and malingered) blindess, and this method of testing has no medico-legal value.

However, it was observed that the moderate and marked changes in ampli-

tude and frequency occurred mostly in patients with a well-defined, regular occipital rhythm of about 10-per-second frequency. The same was true, although less marked, in the slow groups. In many patients with fast rhythms, the changes after opening the eyes were usually less pronounced or absent. Abnormal waves of diagnostic significance in epilepsy and similar affections showed a tendency to disappear after the eye was opened; after a few moments, some would reappear. But

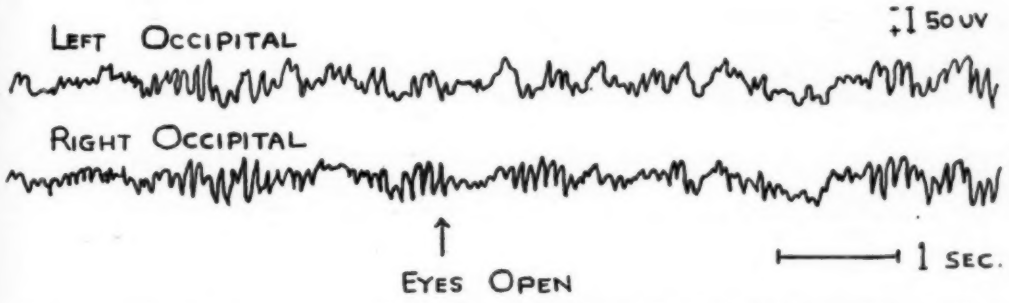

Fig. 6 (Callahan and Redlich). Patient 204; no abnormality of visual mechanisms. Eye opening causes no appreciable change in rhythm or amplitude.

in general, open-eye records were of much less diagnostic aid than was the standard record with the patient's eyes closed.

In 42 patients, we recorded normal EEG changes after the eyes were opened. A card was then held before the patient, and he was asked to read. In 13 of these patients, changes were more marked and more lasting than the changes after the eyes were opened, and in the other 29 they were relatively the same. This variance makes it difficult to arrive at any conclusion in regard to EEG changes with varying use of the eyes. Nor did we find a difference in the normal occipital rhythm after stimulation of the normal eye and fellow eye with advanced pathologic change (such as massive chorioretinitis or optic atrophy).

In a different set of studies, we have used the EEG as a test of light perception to differentiate true from false blindness. This consists of stimulating the eye with a powerful source* of light and recording the galvanic skin response with a Grass electroencephalograph. The galvanic skin response is the bioelectric current accompanying sweat-gland and vasomotor activity induced by sensory stimuli, attention, and various types of psychologic situations. Landis[25] has reviewed the various methods used. A new method of recording it with the EEG has been described by Redlich,[41] in order to differentiate organic from hysterical anesthesia in patients with traumatic injuries of peripheral nerves and spinal cord.

Our tests were carried out in a completely darkened room with the patient resting on a bed. The bioelectric currents were obtained from one solder electrode fastened to the palm with adhesive tape and another electrode attached over a scratched area of skin of the forearm. Bipolar recording was used. Attenuations were set from 7 to 10 on the scale. Low-frequency filters were set on M, and high-frequency filters on four. The tracing was a fairly straight line. After stimulation of the eye with an intense light, a deflection was noted when visual perception was present. The same stimulation of the totally blind eye induced no response (fig. 7).

* 3,000 foot-candles on the eye at a distance of 3 feet.

We examined 26 patients with unilateral blindness and were able to obtain a response from the normal eye in all cases; whereas, no response was obtained after visual stimulation of the blind eye. We did not have the opportunity to observe patients with hysterical or malingered blindness. But, from the work of Levine,[29, 30] and Marquis and Williams,[34] it is to be expected that visual stimulation of a patient with hysterical or malingered blindness would elicit a normal GSR, and thus this method would permit differentiation of organic and psychogenic blindness.

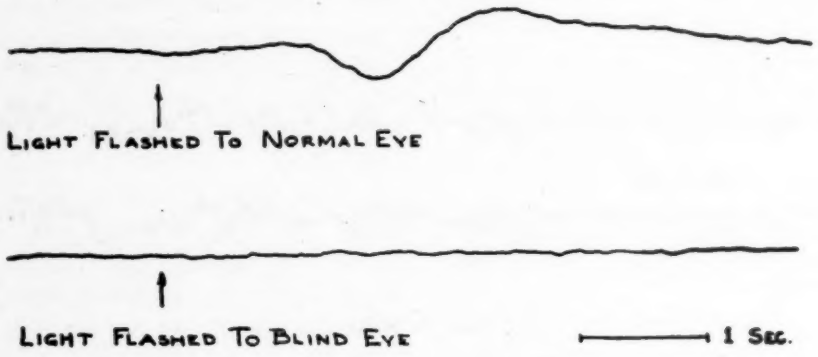

Fig. 7 (Callahan and Redlich). Patient 818; left eye completely blind due to traumatic retinal hemorrhage; right eye normal. Galvanic skin response recorded with electroencephalograph after stimulation of normal and blind eye with 3,000 foot-candles at 3 ft. Monopolar lead.

Localization of cerebral lesions with visual defects

When a lead is placed near cerebral lesions, such as neoplasms or encephalomalacias, which are superficial in location, the waves from this area are generally slow, and if recorded by the localizing bipolar method, can be shown to be "out of phase." By these characteristics, it is possible to determine the approximate location of a superficial lesion (figs. 8 and 9.) In very extensive destruction of cerebral tissue, no brain waves can be recorded at all.

Homonymous hemianopia caused by tumors were studied by Case,[12] who reported a series of five brain tumors involving the optic pathway. In each of the cases, there was a loss of normal occipital rhythm over the affected area. Traumatic homonymous hemianopia was studied by Redlich, Callahan, and Mendelsohn.[44] They reported 12 patients with injury to the parietal, temporal, and occipital lobes with residual hemianopia or quadrianopia to have the following responses: Focal abnormalities were present in seven; generalized EEG abnormalities in three; and no EEG changes in two. Therefore, although the EEG is of more value in the diagnosis of tumors, it is also helpful in the diagnosis of traumatic lesions. The EEG aids in differentiating a hemianopia due to a lesion of the visual radiation and a hemianopia due to an optic-tract lesion because, in lesions of the former, focal lesions are to be expected, and, in the latter, nonfocal abnormalities prevail.

Summary

1. A brief résumé of the history of electroencephalography are presented.

2. Some of the physiologic facts of electroencephalography are presented.

3. The clinical use of the electroencephalogram in neurologic diagnosis is outlined, especially as it concerns various convulsive disorders and localization of

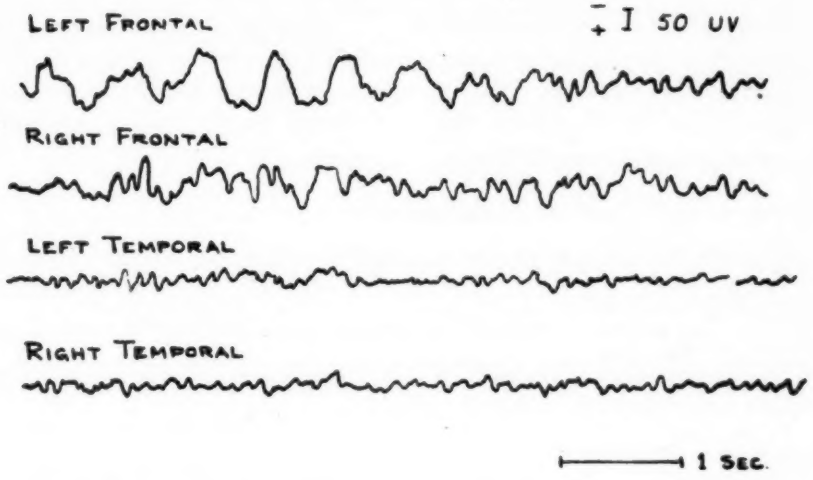

Fig. 8 (Callahan and Redlich). Patient 773. Standard leads. Slow-wave focus in left frontal area. Clinical and pathologic diagnosis: astrocytoma of the left cerebral hemisphere. Monopolar lead.

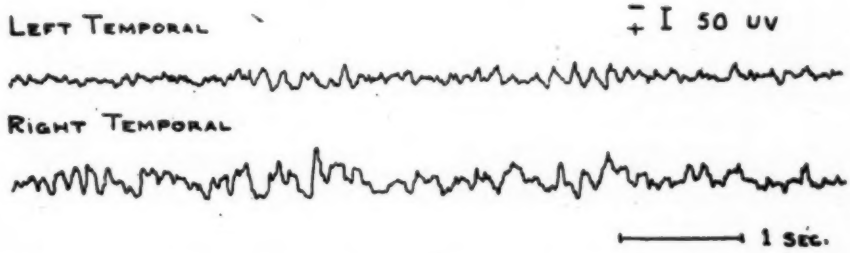

Fig. 9 (Callahan and Redlich). Patient 232; right temporal lobe injured by shell fragment, with left homonymous hemianopsia. EEG shows slow-wave focus in right temporal area. Monopolar lead.

focal cerebral lesions.

4. The technique of recording an electroencephalogram is described.

5. The application of electroencephalography to ophthalmology is discussed as follows:

(A) The use of the EEG to record changes of electrical eye potentials following eye movements. These potentials can be observed only when the retina is present and are thought to be due to the corneoretinal potential difference.

(B) The effect of visual stimulation and the opening and closing of eyes was studied in 100 patients, and an inconclusive statistical scatter of findings resulted. In investigating the effect of the visual stimulus on the normal occipital rhythm, we found, in a study of 30 patients with normal brain waves, that opening and closing the eyes in the dark and in the light had similar effects. The normal occipital wave in man can be driven by repetitive photic stimulation of the retina. No characteristic finding was discovered in 10 cases of amblyopia.

(C) The effect of opening the eye on the normal occipital rhythm does not differentiate true from malingered or hysterical blindness.

(D) We have employed the electroencephalogram to record the galvanic skin response after visual stimulation and, in this manner, true blindness can be differentiated from false blindness.

(E) The electroencephalogram is an aid in localizing cerebral lesions with visual defects. Superficial lesions, especially tumors, frequently show slow waves.

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Discussion

Dr. Clyde A. Clapp (Baltimore, Maryland): Dr. David Harrington wishes to know: "Was there any correlation between the EEG finding and congruity of the visual fields in antero-posterior localization of cerebral lesions?"

Dr. Callahan (closing): The question refers to the hypothesis that the more posterior the lesion is located, the more congruent are the field defects, and Dr. Harrington wishes to know if we found evidence to support or disprove this theory. We did not make a study of our cases for this relationship. Case has reported seven cases of homonymous hemianopsia, proved at surgery to have tumors of the optic tract, which showed a loss of normal occipital rhythm over the occipital cortex.

HEREDITARY NYSTAGMUS OCCURRING AS A SEX-LINKED CHARACTER RECESSIVE IN THE FEMALE*

C. WILBUR RUCKER, M.D.
Rochester, Minnesota

Hereditary nystagmus appears as a constant, horizontal, to-and-fro movement of the eyes, pendular in type, at the rate of about 120 beats per minute, of small excursion on forward gaze and coarser on looking to the sides. Even among members of the same family it varies somewhat in rate and amplitude; it may show a quick component on lateral gaze, and may be more pronounced on turning the eyes to one side than when they are turned to the other. Visual acuity is usually fairly good, generally 20/30 to 20/50, in spite of the constant motion of the eyes, and would probably be still better if only the eyes could be made to stand still. Reduction in visual acuity seems not to be the cause of the eye movements, yet the nystagmus is somewhat similar to that resulting from defective vision.

Hereditary nystagmus must be distinguished from nystagmus due to such conditions as congenital cataracts, corneal scars, macular lesions, and albinism. In all of these conditions, visual acuity is reduced for reasons evident to the examiner. In hereditary nystagmus, the eyeballs are normal, and there is no significant refractive error. In some cases, there is an accompanying shaking of the patient's head.

Nystagmus is said to be inherited in any one of several different ways—as a Mendelian dominant or recessive character, or as a sex-linked character. In most reported families, it seems to be transmitted in a partially sex-linked fashion, as in the first family described in Nettleship's[1] paper in 1911. In that author's second family, it was transmitted as a sex-linked character entirely recessive in the female, as it was in the cases to be reported herein. The literature contains descriptions of relatively few families of this latter type, one of them being that of Waggoner and Boyd[2] published in 1942. Since these authors appended a list of pertinent references to their report, its repetition is unnecessary here.

REPORT OF CASES

The propositus of the family to be reported herein was a 7-year-old boy (individual 27 in generation VI in figure 1) whose father brought him to the Clinic to have an operation performed on his eyes to steady them. The father stated that ever since the boy's birth his eyes had been in constant motion. On examination there was apparent a small, rapid, horizontal, pendular nystagmus. When the boy turned his eyes beyond 20 degrees to each side, the movements became coarse and less rapid. The refractive error was slight. Visual acuity could not be determined accurately because the boy had not attended school and was shy, but it was definitely better than 20/70.

The father said he had another son (individual 30 in generation VI in figure 1) aged two years, who was similarly afflicted. The nystagmus had been noted "at birth." On examination of this 2-year-old boy a short time later, I found that his condition resembled that exhibited by individual 27 in generation VI. Neither of these boys showed any shaking of the head.

The father said that these boys had a

* From the Section on Ophthalmology, Mayo Clinic.

cousin (individual 24 in generation VI in figure 1), the son of a sister of the boys' mother, who had the same sort of trouble with his eyes. I found that the cousin in question was 7 years of age and that the movement of his eyes had been first discovered by his parents when he was six months old. Nystagmus on forward gaze was horizontal and pendular, small

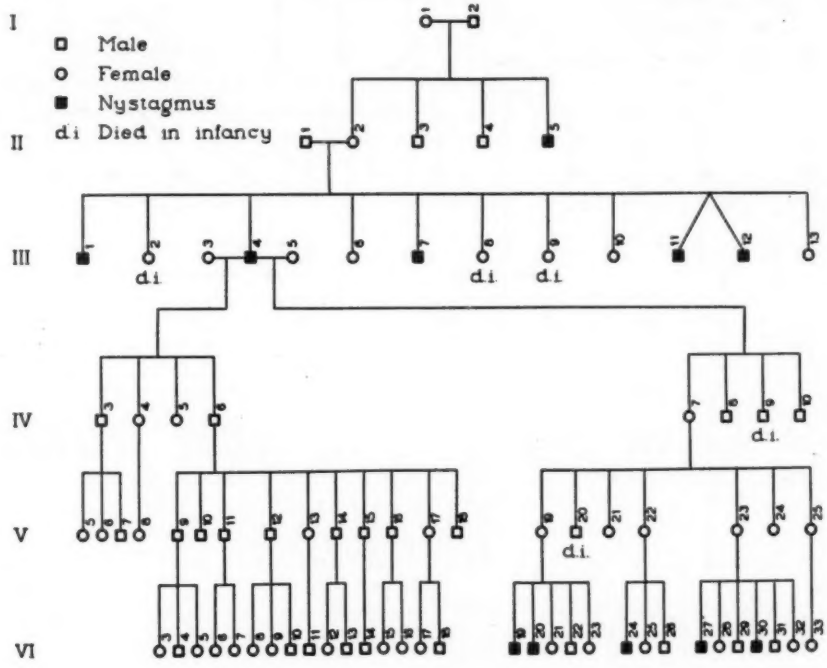

Fig. 1 (Rucker). Genealogic tree showing descendants of individual 4 in generation III. This individual was married twice (to individuals 3 and 5 in generation III).

in amplitude, and coarse on the patient's looking to the sides. Its rate was about 120 beats per minute, although at times it stopped altogether. There was an accompanying side-to-side shaking of the head, a negation movement, not synchronous with the eye movements. The jerking of the head and eyes was thought by the parents to be lessening, but became pronounced when the boy was tired. Visual acuity was 20/30 in each eye.

The two boys first mentioned (individuals 27 and 30 in generation VI in figure 1) had two other cousins who also had nystagmus. These cousins were sons of another sister of the mother of individuals 27 and 30. Since these two cousins lived several hundred miles away, I had to rely on their mother for a description of their eyes. Individual 19 in generation VI in figure 1, now a boy 10 years of age, has eyes that have been "terribly active" since the age of three months, when he had pneumonia. Individual 20 in generation VI in figure 1, an 8-year-old boy, also has "jerky eyes," first noticed at the age of 6 years, when he had measles.

I examined most of the brothers and sisters of these afflicted boys, and their parents and some of their grandparents, without encountering any further evidence of nystagmus. Not until I examined the half brother (individual 6 in generation IV of figure 1) of the grandmother of the nystagmic boys did I obtain further clues. This half brother himself had normal eyes, as did all his children and

grandchildren (fig. 1), many of whom I examined personally. This half brother, however, told me that his father had the type of jerking of the eyes that I was seeking. With that clue, it became possible to work out the complete family tree.

The father (individual 4 in generation III in figure 1) of this half brother had been married twice. He had 10 brothers and sisters. Every one of his four brothers had nystagmus, whereas all of his sisters were free of it. Their parents (individuals 1 and 2 in generation II in figure 1) had normal eyes, but their mother had a brother (individual 5 in generation II in figure 1), who had nystagmus. This is confirmed by a story in the family that this brother (individual 5 in generation II in figure 1) was visiting his sister shortly before she was delivered of the twins (individuals 11 and 12 in generation III in figure 1), and that "he cast his mark on them," with the result that they, too, were born with nystagmus. Although I have no information about this brother's parents (individuals 1 and 2 in generation I in figure 1) except their names and dates of birth, it will become apparent, after their descendants have been traced, that they must have had normal eyes and that the mother (individual 1 in generation I in figure 1) was a carrier.

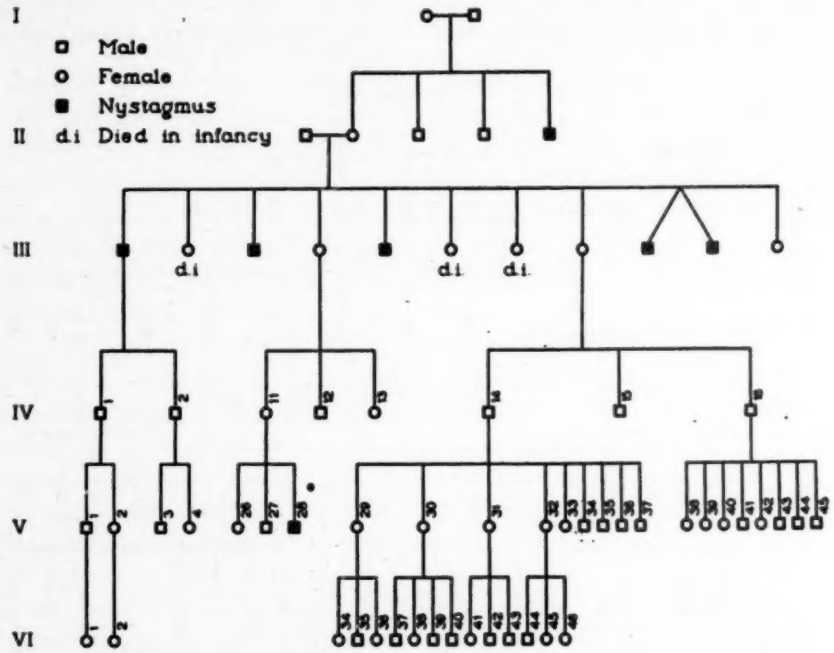

Fig. 2 (Rucker). Descendants of additional members of generation III: those numbered 1, 6, and 10 in figure 1. Generations I, II, and III are repeated.

In figure 2, the eldest male in generation III is said by all who knew him to have had constant side-to-side shaking of his eyes and his head He had two sons (individuals 1 and 2 in generation IV in figure 2), both of whom had normal eyes, as have all of their descendants.

In generation III (fig. 2), the eldest surviving female had normal eyes, and left three children, only one of whom, a daughter (individual 11 in generation IV), married. She has three children, (individuals 26, 27, and 28 in generation

V in figure 2). Individual 28 is a 15-year-old boy who has nystagmus. Although I have not as yet examined him, I have notes made by an ophthalmologist who saw him when the boy was 6 years old. The notes state that the boy has a "searching type" of nystagmus, no significant refractive error, and that he holds his head to one side when reading. By referring to figure 2, it can be seen that the gene for nystagmus which this boy received passed through four female carriers, all of whom had normal eyes. Not one of his direct ancestors through these four generations exhibited nystagmus, yet he has, without question, an inherited disease.

The third male in generation III (fig. 2), who died at the age of 48 years, is said to have had nystagmus which became more pronounced as he grew older. I do not know whether he had a tremor of the head or not. He left no descendants.

The female next to the youngest in generation III bore three sons (individuals 14, 15, and 16 in figure 2), all of whom have normal eyes, as do all of their descendants (fig. 2).

In figure 3 are shown the descendants of "the twins," the youngest males of generation III (individuals 11 and 12 in generation III in figure 1). They both dislike physicians so thoroughly that I have been advised not to attempt to examine them. All who have seen them report that both have nystagmus and also constant shaking of the head. One is said to carry his head bent toward his left shoulder, and the head of the other man is reported to be bent toward his right.

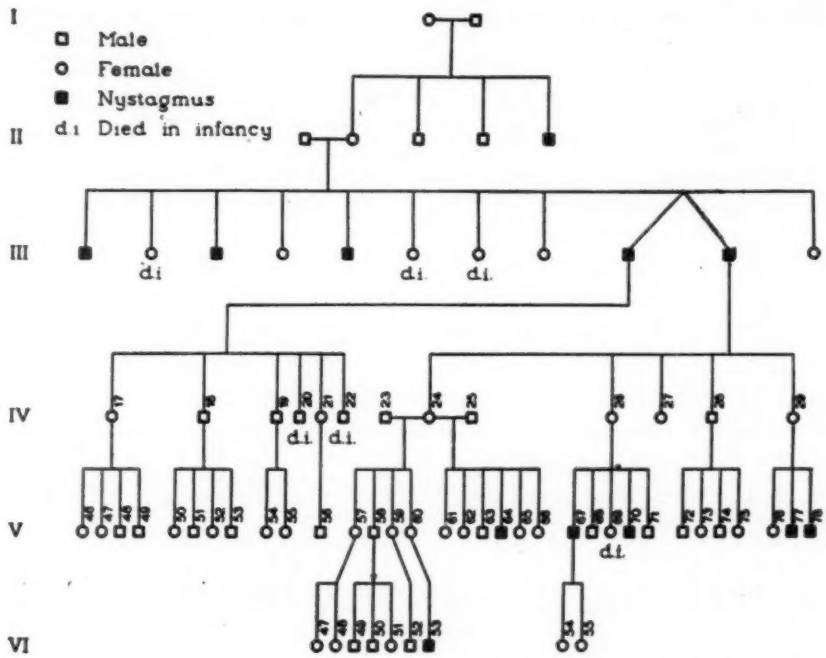

Fig. 3 (Rucker). The descendants of individuals 11 and 12 in generation III in figure 1. These individuals are twins.

The first of the twins has no nystagmic descendants. The second twin has four daughters (individuals 24, 26, 27, and 29 in generation IV in figure 3), all of whom have normal eyes. Of the three daughters

who have married, each has one son or two sons who have nystagmus (individuals 64, 67, 70, 77, and 78 in generation V in figure 3). The eldest daughter (individual 24 in generation IV in figure 3) has a grandson (individual 53 in generation VI in figure 3), a 2-year-old boy, who has constant horizontal nystagmus which becomes coarse on his looking to the left, and diminishes on his looking to the right.

Individual 64 in generation V in figure 3, a 5-year-old boy, has nystagmus, his mother says, only when he is tired or angry.

Individual 67 in generation V in figure 3 is a 25-year-old man who has a pendular, horizontal nystagmus. The movements are short and quick on forward gaze. When this man reads for a time the movements become greater, and a small head jerk appears. Visual acuity is 20/70 with the right eye and 20/50 with the left. With each eye, he can read 14/21 on the American Medical Association reading card. He spent three years during World War II in the supply department of the Army Air Forces.

Individual 70 in generation V in figure 3 is a younger brother of individual 67 of the same generation. He is now 20 years of age. He has a horizontal pendular nystagmus. The movements have a small range on his forward gaze, and become coarse on his looking to the sides, more so when he looks to the right than when he looks to the left. When he reads, he tilts the head to the left. There is no tremor of the head. In spite of the nystagmus and several diopters of myopia, his visual acuity with correction is 20/45 in the right eye and 20/40 in the left. He reads 14/14 on the American Medical Association reading card with each eye. He spent

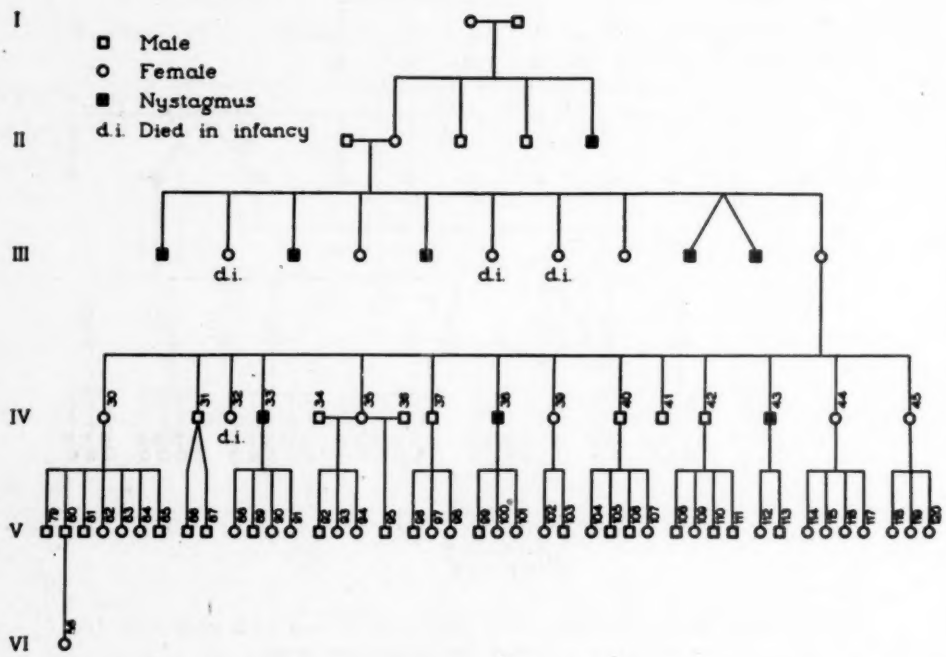

Fig. 4 (Rucker). The descendants of individual 13 of generation III in figure 1.

six months of World War II in the Navy, and was discharged because of his ocular trouble.

Individual 77, aged 5 years, and individual 78, aged 1 year, both of generation V in figure 3, are brothers who, their mother says, are afflicted badly with the jerky eyes possessed by several of her relatives.

The only son of the second twin is individual 28 in generation IV in figure 3. He has four children, all of whom have normal eyes.

As shown in figure 4, the youngest female of generation III bore 14 children. Her five daughters have normal eyes; a sixth daughter who died in infancy also had normal eyes. Of her eight sons, three are nystagmic. As yet, none of her grandchildren has shown evidence of nystagmus. The explanation may be that her eldest daughter (individual 30 in generation IV in figure 4), who is the only one with many children, may happen not to be a carrier; and her two youngest daughters (individuals 44 and 45 in generation IV in figure 4) have given birth only to girls. Twenty-two of her 42 grandchildren are offspring of her two sons and would not be expected to be nystagmic.

The first son of this youngest female in generation III to show nystagmus was individual 33 in generation IV of figure 4, a man now 42 years of age. His eye movements are horizontal and pendular. His vision, with correction of one diopter of astigmatism in each eye, is 20/40.

Individual 38 in generation IV in figure 4 is now 37 years of age. His eyes have a constant pendular motion, about 100 beats a minute, which is a slower rhythm than that shown by most of his relatives whom I have examined. As in the case of the others, the movements on looking to either side become coarse. On the American Medical Association reading card he reads 14/24 with his right eye, and 14/35 with his left. His shuffling gait and clumsy behavior suggest that his neurologic disturbance may not be limited to his eyes.

Individual 43 in generation IV in figure 4, a man 28 years old, is said by members of his family to have a "slight jerking" of his eyes. I have not examined him.

Comment

In this family tree in which there are 231 members in 6 generations, 21 individuals had nystagmus. All were males, and all inherited it through females who themselves were not affected. In a number of instances, the gene passed through a chain of several females before it became evident in a male descendant. In no case has a male transmitted the defect to his son. All descendants of nonaffected males are free from the defect. In this family, then, the character is sex-linked, and without exception has been recessive in the females. Its gene is carried in an X-chromosome, as is the gene for hemophilia and that for red-green color blindness.

Nettleship, on the basis of his observations, concluded that in families in which nystagmus was inherited as a sex-linked character, recessive in the female, associated head movements occurred rarely, and that in families in which both males and females were affected, head movements were common. This has not been my experience, for in the family reported herein a considerable number of the nystagmic persons did have associated head movements. Furthermore, in some of my unreported families in which the mode of inheritance is different from that encountered in the present family, I find head movements uncommon. The manner of inheritance seems not to be related to associated head movements.

Waggoner and Boyd in their report called attention to the frequency of associated neurologic disturbances. These were present in a few of the members of the family reported on herein, but could not be classified for want of neurologic examinations. Most of the nystagmic persons seemed to be free from other disturbances, so far as I could judge from their actions. If a competent neurologist had had the opportunity to examine all members of this family, he might have been able to find some type of disturbance associated with the nystagmus, for the difficulty appears to lie in the central nervous system. Neither albinism, nor high refractive error, nor defective visual acuity can account for the nystagmus, because these conditions were absent in most cases. Furthermore, several mothers were certain that the nystagmus had been present at birth or within a few days thereafter. Since the macula is not completely differentiated until about four months after birth, and evidence of fixation is not present until about the same time, the nystagmus could not have been dependent on any derangement of vision, because it appeared before visual acuity had had time to develop. At present, it seems futile to try to guess where within the central nervous system the disturbance lies.

With a complete family tree available, and with the knowledge that in every instance the nystagmus has been inherited as a sex-linked character, recessive in the female, it is now possible to give reliable advice to members of this family. Several have sought such advice and have been grateful for it. As an aid in explaining the transmission of a sex-linked character, the simple diagram reproduced in figure 5 was drawn. It shows that all the children of an affected male will have normal eyes, but that the daughters will transmit the defect to half of their sons. It is well for nystagmic persons to know this. The diagram also shows that all the descendants of normal males are free from this condition, a fact which has given comfort to several such members who feared they might have nystagmic children.

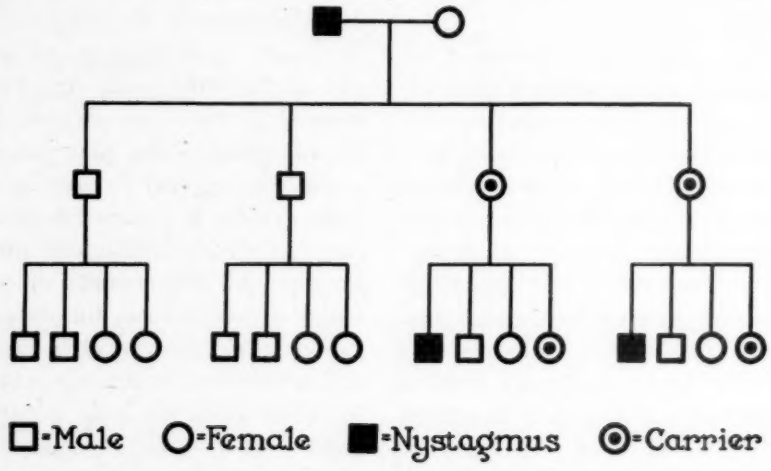

Fig. 5 (Rucker). Diagram of the mode of inheritance of a sex-linked characteristic which is recessive in the female.

It is unfortunate that in the human race a single characteristic can be transmitted in one of several different ways. Often, one is able to predict the future course of

a hereditary defect only after studying the transmission of that defect through several generations of a family. Once the mode of transmission is known, however, the future is clear and certain, and the physician is in a position to give helpful advice to members of that family.

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THE INFLUENCE OF BARBITURATE ON VARIOUS FORMS OF NYSTAGMUS*

M. B. BENDER, COMDR. (MC) (S), U.S.N.R.
New York
AND
F. H. O'BRIEN, LT. COMDR. (MC), U.S.N.R.
Montreal, Canada

One of the signs of mild barbiturate intoxication is nystagmus. This is apparent when the patient turns his eyes on command or when he attempts to look in any direction. Any movement of the globes from the mid position is accompanied by nystagmus. The patient is also unable to maintain his eyes in a deviated position. Apparently, barbiturate in sufficient concentration interferes with normal ocular movement in man.[1] Barbiturates also influence eye movements in cats.[2] According to Spiegel and Collins,[3] the ocular effects (rotation of eyes) are produced by the action of the drug on the brain stem. They suggested that barbiturate anesthesia causes a disequilibrium between the right and left vestibular nuclei and consequent homonymous rotation of the eyes. From their experiments, however, changes in the position of the eyes produced by barbiturate are due not only to the action of the drug on the central vestibular mechanism, but to action on other parts of the brain as well.

The object of this investigation was to determine what effect the barbiturate had on nystagmus and the ocular movements in man. Patients with lesions of the peripheral vestibular apparatus, brain stem, or cerebrum were studied. In addition to this group, patients with various forms of nystagmus were examined after they had been injected with sodium amytal. When possible, the effects produced by intravenous injection of sodium amytal were correlated with the clinically determined lesion. In some instances, however, the nature and location of the pathologic process could not be ascertained, but since the cases revealed what seemed to be pertinent data, they were included in this study. To make the investigation more complete, we also included a series of psychiatric patients who showed no true physical defects and who were given intravenous injections of sodium amytal (narco-analysis and narco-synthesis).†

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* From the U. S. Naval Hospital. The opinions and views set forth in this article are those of the writers and are not to be construed as reflecting the policies of the Navy Department.

† Since these patients showed no signs of organic disease (specifically of the visual, oculomotor, or vestibular systems) we considered them as a normal control series. Those individuals who showed hysterical ocular palsies were classified in the pathologic group.

Method

Before the administration of the drug, all the patients were examined from the neurologic standpoint. They were also tested with the striped drum for the presence of opticomotor nystagmus.[4] The alternately black and white stripes, one-half inch in width, were situated on the curved surface of a cylindrical drum, 8 inches in diameter and 10 inches high. The drum was slowly rotated with its axis either in the vertical or horizontal plane, and the patient was instructed to watch the moving stripes in the center of the drum. In the normal individual, this procedure yields a nystagmus known as opticomotor or the "optokinetic" type.[5] In many instances, these preliminary studies were augmented by Bárány turning, and caloric and galvanic stimulation tests of the semicircular canals. The drugs administered were sodium amytal, sodium pentothal, and sodium luminal. In most cases, however, sodium amytal was used. The drug was injected into the antecubital vein at a rate of 0.1 gm. per minute for a total of 0.3 to 0.5 gm. The patient was seated and engaged in conversation so as to prevent his falling asleep. He was repeatedly asked to accomplish simple tasks which required his visual attention. The ocular findings were recorded chronologically in minutes.

Results

I. Normal group

From two to three minutes after the injection of the drug, a slow and coarse nystagmus was observed when the patient attempted to turn his eyes in any one direction. The nystagmus fluctuated in amplitude and rate of ocular excursions. The change occurred every 90 to 120 seconds and was evident during ocular deviation in the horizontal plane. At one period, the nystagmus was more pronounced on right lateral gaze, whereas at another time (90 to 120 seconds later), it was most manifest with the eyes in the left lateral positions.

Opticomotor nystagmus induced by the rotation of a striped drum was invariably abolished about two minutes after the administration of the drug. This physiologic nystagmus remained absent for two and sometimes three hours, even though the patient (a) had a small dose (0.1 gm. of drug), (b) his attention was intact, and (c) his convergence power was preserved.

Comment. All of these findings were consistently present in every normal individual tested. They show that (a) barbiturates produce a nystagmus which seems to fluctuate periodically and is most apparent during ocular deviation, and (b) barbiturate abolishes reflex opticomotor nystagmus.

II. Patients with lesions of the vestibular nerve

Case 1. W. H. H., a 19-year-old apprentice seaman, was admitted to the hospital with clinical and laboratory evidence of meningococcic meningitis. He recovered with penicillin therapy. However, during his convalescence, it was noticed that he was very unsteady in his gait and station.

Repeated caloric (cold irrigation of ear canals) and Bárány tests of vertical and horizontal canals failed to yield nystagmus, past pointing, or vertigo. His hearing was only slightly diminished. There was complete bilateral loss of vestibular function in this man.

Opticomotor nystagmus was not tested.

Pharmacologic Tests. Sodium amytal (0.5 gm.) was slowly injected into the arm vein. Within two minutes, definite nystagmus appeared when the patient turned his eyes in any direction except upward. This nystagmus persisted for more

than two hours. During this period the patient was somewhat drowsy.

Case 2. R. D. S., a seaman, second class, aged 19 years, was admitted to the hospital in a comatose state. He had signs of meningeal irritation, and his temperature was 104°F. Laboratory studies established the diagnosis of meningococcic meningitis. He recovered under sulfadiazine and penicillin treatment. When he regained consciousness, he was found to be totally deaf in the left ear and could hear only loud noises in the right. There was spontaneous past pointing with both hands to the right. The gait was broad based and unsteady. There was no spontaneous nystagmus.

Opticomotor Tests. Prompt nystagmus was obtained on confrontation when the striped drum was revolved in the vertical or horizontal planes. All responses were normal.

Caloric Tests. Irrigation of both ears for three minutes with ice-cold water yielded no nystagmus, past pointing, nor vertigo. On one occasion, upon douching of left ear (for stimulation of vertical canals only), a fine transient nystagmus was noted when the eyes were in the extreme right lateral position. This nystagmus varied in intensity from one minute to another.

Bárány Tests. Rotation in clockwise or counterclockwise directions with stimulation of horizontal and vertical canals failed to elicit ocular responses or vertigo. There was absolutely no nystagmus or past pointing. All of these tests showed absence of labyrinthine functions.

Pharmacologic Tests. Sodium amytal (0.5 gm.) was administered intravenously within six minutes. After 0.2 gm. had been injected, the opticomotor nystagmus decreased, and after the administration of 0.3 gm. of the drug, this type of nystagmus could not be demonstrated. In other words, the opticomotor nystagmus was abolished.* Two minutes after the initial administration of the amytal was made, a coarse nystagmus appeared when the patient turned his eyes to the extreme lateral upward or downward positions. The nystagmus was more apparent to left than to right and more on downward than on upward gaze. However, the nystagmus was found to fluctuate in its amplitude and rate with change in direction of gaze. One minute, the nystagmus was more marked on left lateral gaze; the next minute, it was more apparent on right lateral deviation.

The patient was observed for two hours. During this period, an alternation in the degree of nystagmus was noted, especially when the patient attempted to maintain his gaze in a lateral position. The same was noted when he tried to keep his eyes either in an upward or downward position. When the nystagmus was found to be pronounced in one direction, it was found to be less marked when the eyes were turned in the opposite direction. This periodicity in amplitude and degree of nystagmus was a frequent finding, even in the normal individual.

Comment. In both of these cases (1 and 2), there was evidence of loss of function in the peripheral vestibular apparatus. Meningitis affected both vestibular nerves. Despite the absence of labyrinthine functions, intravenous administration of barbiturate produced nystagmus just as in the normal individual. From these observations, it would appear that the nystagmus produced by barbiturate is not due to irritation of the peripheral portions of the vestibular organ. The effect seems to be central.

* Since the observations on the ocular movements were made with the unaided eye it is not certain whether the opticomotor nystagmus was completely abolished. Small nystagmoid-ocular excursions might have been present during fixation of the rotating drum.

III. PATIENTS WITH LESIONS IN THE BRAIN STEM.

Case 3. J. F., a middle-aged veteran of the first World War, was admitted to the hospital on July 26, 1944, with a history of sudden onset of dizziness, staggering gait, nausea, and vomiting of three weeks' duration. Examination revealed the blood pressure to be 150/100. There was nystagmus on deviation of eyes to the left and paralysis of conjugate gaze upon shifting them to the right. There was also right peripheral facial weakness. The gait was unsteady.

Opticomotor Tests (performed on August 15, 1944). Counterclockwise rotation of the striped drum with its axis in the vertical plane produced slight and slow deviation of the eyes to the right but not much beyond the vertical meridian. There was no nystagmus. In other words, the expected recovery or quick component to the left was not present. Clockwise rotation of the drum elicited prompt nystagmus (with slow deviation of the eyes to the left and pronounced quick component of the nystagmus to the right).

Bárány Tests. Clockwise rotation of the chair immediately produced chin and eye deviation to the left. On cessation of 10 turns (made within 15 seconds), the patient fell to the right. There was marked increase in the nystagmus on left-lateral gaze. This was most apparent in the left eye. Vertigo was present. Counterclockwise rotation of the chair produced no chin nor eye deviation. On cessation of 19 turns, the patient was dizzy, the eyes were deviated to the left, and he was unable to move his eyes toward the midline to the right. There was absolutely no nystagmus, falling, nor past pointing.

Caloric Tests (performed on August 22, 1944). Irrigation of the right ear with ice water for 90 seconds produced vertigo, past pointing, falling reactions to the right, and an increase in the nystagmus when the patient turned his eyes to the left. Irrigation of the left ear for 180 seconds abolished the spontaneous, preëxisting nystagmus to the left, and yielded slight vertigo, some pallor, and slight past pointing to the right. There was no nystagmus except for minimal jerks with a quick component to the right.

Pharmacologic Tests (performed on August 15, 1944). Sodium amytal (0.3 gm.) was injected intravenously over a period of five minutes. Slight, slow, coarse nystagmus in all directions of gaze was noted after the first two minutes of injection. The nystagmus was most pronounced on left-lateral gaze and was minimal on attempted right-lateral gaze. An additional 0.1 gm. was administered (total 0.4 gm.) and, four minutes later, ocular deviation to the right could be accomplished but not maintained. Although the globes were turned to the right of the vertical meridian, slow movements of the eyes were noted. The movements were to the left (toward the mid position), and it became apparent that the patient was unable to maintain his gaze to the right. On lateral gaze, the nystagmus was rapid and fine, especially marked in the left eye. These ocular phenomena were present for the next 15 minutes of the study.

As in previous cases, opticomotor nystagmus was abolished. Soon after the injection of 0.1 gm. of the drug, the patient declared that his vision was better. He claimed that it was no longer blurred and that the dizziness had disappeared.

Comment. Clinically, this case showed signs characteristic of a lesion in the pons at the level of the facial nucleus. In this patient, barbiturate definitely altered

the ocular movements. Thus conjugate gaze which was prolonged to the right before the injection became apparent after the injection of the drug. The reappearance of eye movement to the right was associated with a nystagmus to the right. The nystagmus to the left became much more pronounced and more rapid.

Case 4. R. B. F., a young Marine Corps aviator, was admitted to the hospital on August 16, 1944, with a history of acute onset of extreme dizziness, nausea, and vomiting of five days' duration. Examination was negative except for the ocular findings. On direct forward fixation there was fine nystagmus with a quick component to the left. The nystagmus became more conspicuous as the eyes were deviated to the left. Nystagmus was also present on upward and less marked on downward gaze. There was no nystagmus on gaze to the right. The patient complained of marked dizziness when he turned his head and eyes to the left.

Opticomotor Tests (performed on August 19, 1944). Clockwise rotation of the drum with its axis in the vertical plane failed to elicit nystagmus on repeated tests. Counterclockwise rotation of the drum in the vertical position consistently produced prompt nystagmus with a slow component to the right (in the direction of rotation) and a quick (recovery component to the left.* Clockwise or counterclockwise rotation of the drum with its axis in the horizontal plane produced no nystagmus.

Bárány Tests (performed on August 24, 1944). Clockwise rotation of the patient sitting in the Bárány chair produced marked exaggeration of the nystagmus to the left with vertigo and past pointing. Counterclockwise rotation (8 turns within 10 sec.) yielded a lesser, fine, and more rapid type of nystagmus to the right and only slight past-pointing reaction.

Pharmacologic Tests (performed August 19, 1944). Five-tenths gram of sodium amytal was administered by vein within four minutes. The patient became markedly somnolent and required frequent rousings in order to carry out the study. Nystagmus became evident on gaze to the right and markedly lessened on gaze to the left. Eleven minutes after the final dose was injected, nystagmus was abolished in all directions of gaze and remained absent for two hours during which the tests were performed. Opticomotor nystagmus was similarly abolished and returned three hours after the drug was injected. As the effect of the drug diminished the nystagmus on lateral gaze reappeared. Diplopia on forward fixation at about one meter's distance occurred as an early effect and persisted for about 45 minutes.

Comment. Although there is no conclusive proof that the lesion in this case was in the brain stem, the persistence of the nystagmus on left-lateral gaze for several days and the presence of nystagmus in the vertical plane suggested that the pathologic lesion was central, probably in the brain stem.[6] Furthermore, the fact that the nystagmus induced by the opticomotor drum was reversed or found to be present only in the direction opposite to that elicited on examination is, according to Brunner,[7] a sign that the pathologic nystagmus is central and nonlabyrinthine. The latter conclusions were confirmed by Scala and Spiegel[5] in experiments with cats. In this case, barbiturate markedly decreased the pathologic nystagmus (which was present on at-

* These were performed three days after admission, at which time the patient's symptoms had somewhat subsided.

tempted left-lateral gaze) and produced a nystagmus on right-lateral gaze.

IV. Patients with lesions in the cerebral hemispheres.

Case 5. G. B., a 22-year-old Marine, was shot in the right temporal region. X-ray studies revealed a metallic fragment situated deep in the right-temporal lobe near the thalamus. The injury to the right side of the brain produced a left hemiplegia, hemisensory syndrome, and hemianopia. Besides these, the patient had difficulty in ocular fixation. Not infrequently, the head and eyes deviated tonically to the left, especially while he was fixating a target. These, of course, were involuntary and noted on repeated occasions during the entire observation period.

Bárány Tests. Turning tests, clockwise and counterclockwise, yielded essentially normal responses as to nystagmus, past pointing, and vertigo. There was no difference between the ocular reactions on right- and left-lateral gaze. There were no defects in conjugate deviation.

Opticomotor Nystagmus. Clockwise rotation of the striped drum with its axis in the vertical plane produced normal opticomotor nystagmus. Counterclockwise rotation in the same plane also yielded nystagmus, but the quick components to the left were diminished. Rotation of the drum with its axis in the horizontal plane resulted in a nystagmus. This was more pronounced when the drum was rotated in an upward than in a downward direction.

Pharmacologic Tests. Slow intravenous injection of 0.5 gm. of sodium amytal produced the usual barbiturate nystagmus; it was found to be present on vertical or horizontal gaze. There was no apparent inequality between the right and left sides. Moreover, there were no disturbances in conjugate gaze to either side. The patient was able to maintain his gaze to the left just as well as to the right. Opticomotor nystagmus was not found with rotations of the striped drum in any direction.

Comment. In a patient, with a lesion in the right cerebral hemisphere, who showed difficulty in ocular fixation, intravenous injection of sodium amytal produced: (a) the usual barbiturate nystagmus, (b) no disturbances in ocular gaze, (c) no difference between the right and left sides, and (d) abolition of opticomotor nystagmus just as in the normal individual. In other patients with disturbances in ocular fixation due to a lesion in the right frontoparieto-occipital regions, intravenous barbiturate failed to reveal changes that were significantly different from those found in the normal.

Thus it appears that barbiturate does not materially influence the ocular defects caused by lesions in the cerebral hemisphere. The responses are the same as in the normal, and this is in contrast to the findings in cases of brain-stem lesions. From the available data thus far cited, it would seem that: (a) nystagmus produced by barbiturate is not due to irritation of semicircular canals, as demonstrated by cases 1 and 2; (b) barbiturate influences ocular responses in patients with lesions of the brain stem, as demonstrated by the reversal of direction of nystagmus, by the abolition of the pathologic unilateral nystagmus, and by the provocation of nystagmus to the normal side; (c) barbiturate has no apparent effect on eye movements in patients with lesions in the cerebral hemisphere; and (d) barbiturate abolishes the opticomotor nystagmus normally elicited with the striped drum. Evidently the action of the drug is manifested either by the production of a nystagmus (apparent when the eyes are held approximately in mid posi-

tion, or by the abolition of nystagmus (with the eyes fixating in the mid position). The latter was also observed in cases of latent nystagmus.*

V. Patients with various forms of nystagmus:

A. Latent Nystagmus.

Case 6. A. P. W., an 18-year-old seaman, second class, had been aware of difficulty of vision since the age of six years. He had noted that whenever he closed one eye, objects within his gaze quivered and moved back and forth in a horizontal plane (oscillopsia). This subjective impairment was more marked in the right eye than in the left. There was no such oscillopsia with both eyes open.

Examination revealed a divergent squint and paralysis of convergence. Visual acuity was diminished when each eye was tested separately, in the right eye more than in the left; binocular vision was much better. On covering either eye, a marked nystagmus was noted in the uncovered as well as the covered eye. The same type of nystagmus was obtained by splitting the binocular vision. This was accomplished by holding a cardboard between the two eyes in the sagittal plane. There was no spontaneous nystagmus on binocular fixation in any direction.

Opticomotor Tests. Direct confrontation with the revolving, striped drum in the vertical or horizontal position did not produce nystagmus. However, a slight nystagmus was obtained when the drum was in the vertical position but held a little to the right or left of the midline.

Bárány Tests. Marked coarse nystagmus was produced by the usual rotation of the chair in clockwise and counterclockwise directions. However, there was minimal past pointing and no subjective vertigo.

Pharmacologic Tests. Sodium amytal administered intravenously elicited the following results. A total of 0.35 gm. of the drug was delivered in divided doses in three minutes. At the end of this period, nystagmus was observed on right- and left-lateral gaze. The latent nystagmus previously found on uniocular fixation was no longer present and remained absent for the next 25 minutes. Visual acuity on uniocular fixation was much improved. Opticomotor nystagmus could not be obtained with eyes held in mid position.

The patient was observed for 90 minutes. During this period, it was found that the nystagmus, on horizontal gaze, presumably induced by the drug, varied in speed and amplitude from side to side. At one moment, it was more pronounced to the right, at another to the left side, with reversal occurring approximately at one-minute intervals. It was also noted that, as recovery from the barbiturate became generally manifest, the latent nystagmus reappeared.

Comment. The barbiturate in this patient abolished a nystagmus (latent nystagmus). Observation in 12 other cases of so-called congenital nystagmus revealed the same results in all but two. The abolition of nystagmus was invariably accompanied by a subjective and objective improvement in visual acuity. Such improvement has been noted in many patients with such nystagmus and one of these cases was described in detail elsewhere.[8]

B. Voluntary Nystagmus.

Case 7. A. R. G., a Marine, aged 25 years, was admitted to the hospital for investigation of recurrent attacks of un-

* Latent nystagmus can be demonstrated by covering one eye or by splitting binocular vision by holding a piece of paper close to the bridge of the nose in the sagittal plane. The nystagmus elicited only with monocular vision is apparent even when the eyes are in the mid position.

consciousness with accompanying paralysis of the right arm and leg. These were ultimately found to be psychogenic. Physical examination was remarkable only in the presence of fine, rapid, horizontal nystagmus to either side, which the patient claimed was voluntary. He was able to demonstrate the nystagmus quite at will. The nystagmus was more of a tremor of the eyes, rather than the to-and-fro lateral movements. There were no quick and slow components. He stated that he had been aware of a spontaneous "shaking" of his eyes, six years before he entered the service. He also claimed that, during his production of the nystagmus, objects widened in the horizontal but not in the vertical plane. Apparently he learned to bring this about by his own volition and to stop it in the same fashion.

Opticomotor tests were not performed.

Bárány Tests. Clockwise rotation of the chair yielded nystagmus to the left; counterclockwise turning yielded nystagmus to the right. The responses were slight and of brief (3- to 5-sec.) duration. There was minimal vertigo and past pointing. Vigorous and prolonged turning did not exaggerate the results. Interestingly enough, the patient was able to alter this induced nystagmus at will. It was manifested by an increase in the degree of eye movements (nystagmus) elicited by the turning chair. He could superimpose his voluntary nystagmus upon the nystagmus produced by the Bárány turning tests.

Pharmacologic Tests: Sodium amytal (0.5 gm.) was administered intravenously in about five minutes. At the end of four minutes, slight coarse nystagmus was present in the horizontal gaze. There was little or no nystagmus on upward gaze. The patient was somewhat drowsy for 20 minutes. Voluntary nystagmus was attempted but failed. This time he had no "control of the eyes." Strong effort to produce voluntary nystagmus resulted only in an upward rolling of the eyeballs. The inability to produce nystagmus at will lasted 40 minutes. Finger-to-nose tests showed no ataxia. There were no gait disturbances and the station was secure.

Comment. Here is another example of the abolition of a form of nystagmus (voluntary). Although this patient did not have clinically demonstrable signs of a lesion, he did seem to show a decreased or minimal reaction to vestibular stimulation. The most remarkable feature in this case was the voluntary production of nystagmus and its abolition with barbiturate.

C. Postural Nystagmus.

Case 8. R. M. S., a steward's mate, second class, aged 19 years, complained of motion sickness. He had been troubled for as long as he could remember with nausea and vomiting when riding in vehicles. He had never been able to lie flat upon his back without a feeling of marked dizziness, but had always slept with his head supported by a pillow. General examination was negative except for the fact that sudden retraction of the patient's head produced fine and very rapid vertical nystagmus and extreme vertigo.

Opticomotor Tests. Prompt, normal responses were obtained with rotation of the striped drum in any plane.

Bárány Tests. With only three turns of the revolving chair in either direction, severe vertigo and nausea ensued with accompanying rapid, coarse nystagmus, past pointing, and falling reactions of typical type. The nystagmus thus induced lasted well over 15 seconds.

Pharmacologic Tests. Intravenous sodium amytal (approximately 0.4 gm.) was administered within six minutes. Typical barbiturate nystagmus appeared

after 0.1 gm. of the drug had been injected. Opticomotor nystagmus was promptly abolished. The most remarkable effect of the barbiturate was the abolition of nystagmus elicited on retraction of the head. Not only did this nystagmus disappear but the dizziness previously experienced by the patient on this maneuver was also no longer present. When the effect of the drug had worn off, retraction of the head again produced the vertical nystagmus and severe dizziness.

Comment. The cause of the postural nystagmus in this case could not be ascertained. The fact that the nystagmus was manifest only in the vertical plane suggested that the pathologic lesion was in the brain stem.[5] However, Spiegel and Scala[9] were able to produce vertical nystagmus by lesions in the labyrinth. Hence, a peripheral origin could not be excluded. Be that as it may, the most significant finding in this case was the abolition of postural nystagmus by intravenous injection of sodium amytal. Thus far it is apparent that barbiturates influence eye movements either by production or by an abolition of nystagmus. With these facts in mind, we studied the effect of barbiturate in a patient who showed impairment of ocular movements, apparently due to hysteria.

VI. Patients with ocular palsies

Case 9. J. D. G., a 41-year-old Marine, was admitted to the hospital complaining of weakness, fatigue, nervousness, difficulty in walking, twitching of both hands, apparent lapses of consciousness, and sudden spells of unexplained rapid heart action with breathlessness and feelings of apprehension.

Examination revealed staring facies and bizarre gait with alternate dragging of lower limbs. There were numerous bizarre types of twitchings and tremors of hand and feet, and peculiar ataxia of all point-to-point tests. The eye examination showed spasms of convergence and apparent weakness of both external rectus muscles. Lateral eye movements were almost absent. On attempted upward gaze, the eyes rolled upward, exposing the inferior scleras but the upper lids failed to retract. In fact, they partly closed, thus giving a picture similar to Bell's phenomenon. There was no true weakness of the facial muscles. There were inconstant, atypical areas of sensory deficit of hemi-corporal distribution alternating with glove and stocking type of anesthesia. The patient's emotional attitude was one of *belle* indifference. The clinical picture was one of hysteria. This was confirmed, by the history and by subsequent special personality studies.

Pharmacologic Tests: Following intravenous injection of 0.5 gm. of sodium amytal, nystagmus appeared when the patient attempted to direct his eyes away from the mid position. Following the appearance of this nystagmus, his eye movements improved. The apparent weakness of the external recti disappeared. Conjugate eye movements were now good in all directions and associated with barbiturate nystagmus. Upward gaze was prompt and accompanied by normal, concomitant retraction of the superior eyelids. Following this procedure, the patient was able to move his eyes in a normal fashion during the remainder of his hospitalization period.

Comment. Here, again, barbiturate altered eye movements. It is not surprising that sodium amytal abolished hysterical paralysis of ocular muscles—this has been noted by many observers. However, one is not always certain whether the hysterical ocular-muscle palsy is on a conscious or unconscious level. It is possible that the amytal specifically altered ocular function in this case just as it did in the case of voluntary nystagmus. In other words,

the ability to control eye movements was abolished by the amytal. This does not necessarily mean that hysterical ocular paralysis is entirely on a voluntary basis, for we have pointed out that ocular disorders due to organic disease are also influenced by barbiturates. The following case raised the question whether supression of an ocular movement was on a voluntary or involuntary basis.

Case 10. J. C., a 34-year-old steward's mate second class, was admitted to the hospital for study of an internal squint of the right eye which, he claimed, had occurred about three months before admission.

Preënlistment history disclosed poor school and employment records, repeated arrests for alcoholism, and other signs of defective social adjustment. He had always been impulsive and emotionally unstable. Psychometric tests revealed moron or borderline intelligence level.

Examination was essentially negative except for an internal strabismus of the right eye of about 40°. This strabismus seemed to vary in degree. The patient also claimed he could not turn either of his eyes to the right or left. On several occasions, however, it was reported that the patient's eyes were perfectly straight. This was apparent when he was intoxicated with alcohol. During that period, his eyes were not only straight but moved coördinately in all directions. All eye movements appeared normal at this time. This suggested to some observers that the patient was simulating his ocular disorder.

Bárány Tests. These failed to produce significant nystagmus on clockwise or counterclockwise turning. The absence of nystagmus may have been related to his claim that he could not move his eyes to either side (suppression of eye movements?). The usual vertigo, past-pointing, and falling reactions were present. The lack of oculomotor reaction suggested a dysfunction in the vestibular system. However, this was not conclusive. In order to exclude the conscious element or that of malingering (conscious suppression of eye movements), the patient was subjected to special tests.

(1). The patient was stimulated with the electric-shock machine, and a grand-mal seizure was produced. During and immediately following the convulsion, the internal squint disappeared and conjugate eye movements were found to be present. Five minutes after the convulsion, the strabismus returned, also the impairment of horizontal eye movements. At this time and during the next 35 minutes, the patient was amnesic, confused, and totally disoriented. It was assumed that, during this altered mental state, the patient was not conscious of intent to deceive. It is doubtful whether he could simulate the strabismus which returned during this period. And (2), petit-mal seizures, also electrically induced, failed to change the squint although the patient was rendered confused and amnesic. Again, the patient's mental state precluded simulation, and these findings confirmed the observations made following grand-mal seizures. The squint was not due to malingering.

Pharmacologic Tests. Slow injection of 0.5 gm. of sodium amytal into the arm vein produced, within a few minutes, a change in the ocular status. The internal squint disappeared, and the eyes appeared to be normal. There was no nystagmus during this period of observation. Conjugate, horizontal eye movements were executed on direct command, on follow fixation, and on fixation with passive turning of the head. There was no difference between right and left side.

While under the influence of the barbiturate, the patient spontaneously volun-

teered that he had been subject to ocular disturbances for a number of years before enlistment. He had double vision, the right eye turned inward, and the lids squinted. These were particularly apparent when he was "nervous" or emotionally tense.

The pharmacologic study was repeated at a later date, when pentothal sodium (0.1 gm.) was given by intravenous injection. Within one minute, the internal strabismus disappeared. There was no nystagmus. A very transient nystagmus on lateral gaze appeared on the administration of an additional 0.1 gm. of the drug. Again the ocular squint disappeared.

Comment. Barbiturate abolished an ocular squint. The same effects were apparently obtained when the patient was intoxicated with alcohol. The fact that the squint persisted during the period of postconvulsive confusion and during the amnesia produced by an electrically induced petit-mal state, would seem to exclude the possibility of malingering or of voluntary ocular deviation with intent to simulate an illness. If the squint were due to hysteria, it must have been on a subconscious basis. The absence of nystagmus during the period of barbiturate intoxication and on Bárány turning tests suggests an organic disorder in the central vestibular system and not a suppression of eye movements. According to Bartels,[10] lesions or disorder of the central vestibular system may produce ocular squint.

It is improbable that the ocular squint was abolished by action of barbiturate on the ocular muscles. In patients with ocular-muscle palsies, intravenous injections of sodium amytal did not alter the paralysis due to a lesion in the abducens nerve nor did it influence ocular movements in a patient with congenital weakness of all the external ocular muscles.

Discussion

From the foregoing observations, it is apparent that the barbiturates influence eye movements which involve a cortical component (voluntary deviation and fixation). Although the available clinical data cannot explain the *modus operandi* of this effect, they suggest that the site of action of this drug is in the cerebral cortex and partly in the brain stem. Analysis of the case material will show that the most conspicuous alterations in eye movements were noted in patients with disease of the brain stem. However, it is realized that the evidence is not altogether conclusive because the drug probably acts at all levels of the nervous system.

According to Goodman,[11] barbiturate in small doses produces its effect largely by release "phenomena and consequent overactivity in the nervous system, especially in subcortical and lower regions." Release of cortical inhibitory influences on the central vestibular system might thus explain the patient's inability to maintain gaze in any one direction when under the influence of a barbiturate. The inability to maintain voluntary gaze is manifested largely in the form of nystagmoid movements yielding the clinical picture of barbiturate nystagmus. Since voluntary nystagmus and opticomotor nystagmus each involves a cortical component, the same theory may explain abolition of such nystagmus.

This theory, however, does not account for the abolition of positional or other forms of nystagmus cited in the text. Nor does it entirely explain the transitory disappearance of an ocular squint. An additional hypothesis would be that barbiturate, a well-known brain anesthetic,[3, 12] also interferes with impulses going to and coming from the vestibular nuclei. Since the latter have a strong influence on the ocular status,[13]

any alteration in the function of these nuclei will be reflected by a change in eye movements.

Whatever the explanation may be, it is clinically significant that barbiturate abolishes various forms of nystagmus and alters eye movements which involve a cortical component.

Summary

1. Intravenous injections of barbiturate (sodium amytal 0.5 gm.) produces in the normal individual: (a) coarse nystagmus and inability to maintain gaze on voluntary deviation of the eyes in any one direction, and (b) abolition of opticomotor nystagmus as elicited by rotation of a striped drum upon which the patient fixates.

2. Intravenous injection of barbiturate also alters or decreases the nystagmus due to disease of the brain stem and abolishes such types of nystagmus as: (a) latent (nystagmus obtained with monocular fixation or on exposure to darkness), (b) positional (nystagmus obtained on retraction of the head), (c) voluntary (nystagmus obtained by the patient at will), and (d) various forms of so-called congenital nystagmus.

3. Intravenous injection of barbiturate restored eye movements in patients with hysterical ocular palsies and temporarily corrected an ocular squint of unknown origin.

4. It is suggested that barbiturate in mild doses interferes with ability to control eye movements and ocular fixation by its action on the cerebral cortex, brain stem, and intermediate neuronal structures. Eye movements which do not necessarily involve a cortical component might be altered by barbiturate as a result of its action on the brain stem.

1192 Park Avenue.
Neurological Institute.

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THE PATHOLOGIC CHANGES IN RABBIT EYES RESULTING FROM EXPOSURE TO LIQUID NITROGEN MUSTARDS*

WILLIAM O. LAMOTTE, JR., M.D., AND IRVING H. LEOPOLD, M.D.
Philadelphia

Two vesicant agents of potential use in chemical warfare have been designated HN_2 (dichlor-diethyl ethylamine) and HN_3 (trichlor-triethylamine), both known as nitrogen mustards. In order to determine the effect of these agents on ocular structures, rabbit eyes were exposed to varying amounts of each until a standard clinical ocular lesion was established for each agent. A series of such standard lesions was produced for each agent, and the following pathologic studies carried out to determine the type of histologic change present.[1, 2]

The eyes of young chinchilla rabbits were burned on the superior limbus by a standard amount of liquid vesicant agent delivered through a microsyringe.[3] The dose of HN_2 was 0.8 mg. in one series, and this dose was reduced to 0.4 mg. in another series in order to produce a milder lesion. The dose of HN_3 was 0.4 mg. in all instances. The HN_2 eyes were enucleated at 1 hour, 6 hours, 12 hours, 24 hours, 2 days, 3 days, 5 days, 8 days, 12 days, and 3 weeks following burning with the vesicant. The HN_3 eyes were similarly removed at intervals of 2½ hours, 6½ hours, 24 hours, 2 days, 4 days, 5 days, 10 days, 14 days, 33 days, and 16 months. The discussion of pathologic changes concerns average eyes studied at each time interval.

All eyes were fixed in formalin for a minimum of 24 hours, following which they were prepared for histologic section by the celloidin technique. The sections were cut 16μ thick and stained with hemotoxylin-eosin. Photographs were taken to show typical changes at the various stages of the lesions. Detailed protocols of each stage were outlined in the original work, but here a general summary of the pathologic changes will be given.

HN_2 EYES

The conjunctiva is the site of edema and congestion, followed progressively by increasing cellular infiltration, loss of epithelium, necrosis, and degeneration, a process which never reverses in the more severe 0.8 mg. lesion. At the end of three weeks, the conjunctiva in the 0.4 mg. lesion remains edematous, thickened, congested, and infiltrated, with inflammatory cells, but has not undergone necrosis. The corneal epithelium shows slight edema of the basal cells as early as one hour (fig. 1) which gradually increases in severity (fig. 2) so that by 12 hours (fig. 4) the cells are beginning to separate from the underlying stroma, and by 24 hours have largely become lost (fig. 6). Complete denudation persists with attempts at regeneration of epithelium beginning around the third day, such efforts being accompanied by edema of the new cells and repeated loss (fig. 11). The regenerative attempts appear even after the eye has perforated. But at three weeks, complete repair has not even occurred in the milder 0.4 mg. lesion, epithelium being found only over about half the corneal section.

Slight edema at one hour is also the first change observed in the corneal

* From the Department of Ophthalmology of the University of Pennsylvania Hospital. The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and the University of Pennsylvania.

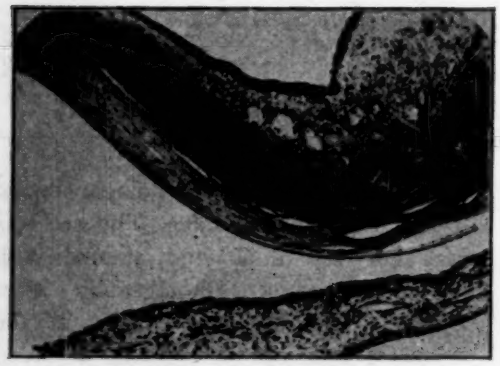

Fig. 1 (LaMotte and Leopold). Limbal congestion, slight corneal and iris edema, empty anterior chamber, intact epithelium and endothelium. 1 hr.

Fig. 2 (LaMotte and Leopold). Edema of basal cells of corneal epithelium. Beginning stromal edema and early cellular pyknosis. 6 hrs.

Fig. 3 (LaMotte and Leopold). Edema, congestion, and thickening of iris. 6 hours.

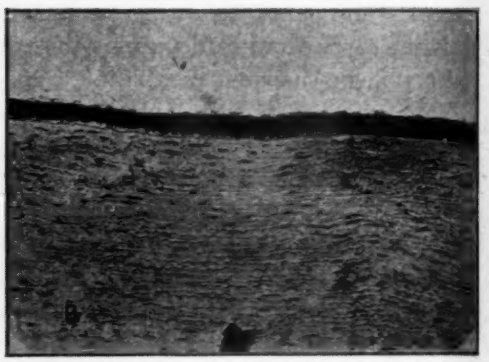

Fig. 4 (LaMotte and Leopold). Continued basal cell edema with beginning separation from stroma. More marked stromal edema. 12 hrs.

Fig. 5 (LaMotte and Leopold). Increased congestion and thickening of iris. Beginning material in anterior chamber. 12 hrs.

Fig. 6 (LaMotte and Leopold). Loss of corneal epithelium, increase in stromal edema, pyknotic stromal cells, poor staining qualities of stroma. 24 hrs.

stroma (fig. 1). This increases slightly during the first six hours (fig. 2), during which time the stromal cells first begin to show very early pyknotic changes and the corneal fibers give evidence of poor staining properties. Yet the stromal changes remain relatively mild until the period from 12 to 24 hours, when the edema becomes marked enough to increase the corneal thickness and the stromal cell damage is sufficient to result in a decrease in the number present (fig. 6). The stage of infiltration with inflammatory cells begins between 24 and 48 hours; in some cases, the infiltration is marked by 48 hours, in others it is not well developed until 72 hours or more. Edema continues to increase during this time, and necrosis proceeds rapidly, for by the second or third day most, or all, of the stromal cells are

Fig. 9 (LaMotte and Leopold). Continued congestion and necrosis of iris and ciliary body. Inflammatory cells in and around iris and ciliary processes. 48 hrs.

Fig. 7 .(LaMotte and Leopold). Continued engorgement and beginning necrosis of iris and ciliary body. Beginning collection of cells in anterior chamber. 24 hrs.

Fig. 8 (LaMotte and Leopold). Corneal epithelium still absent, stromal edema, cellular infiltration already near corneal center, loss of stromal cells, marked exudate in anterior chamber. 48 hrs.

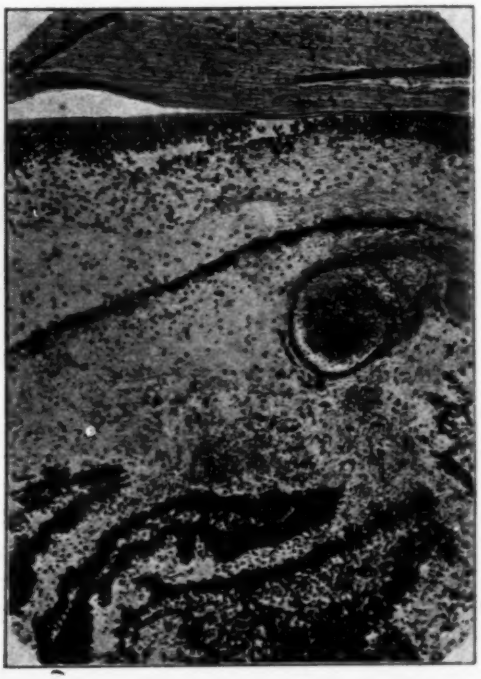

Fig. 10 (LaMotte and Leopold). Section near angle showing marked cellular exudate in anterior chamber, infiltrated cornea, iris, and c.b., with loss of normal detail and structure due to necrosis. 72 hrs.

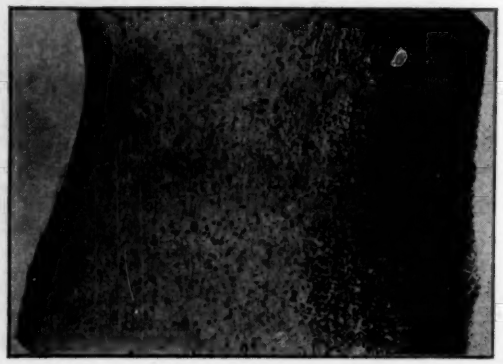

Fig. 11 (LaMotte and Leopold). Great thickness of cornea due to edema and intense cellular infiltration into posterior layers. Edematous regenerated epithelium. 5 days.

Fig. 12 (LaMotte and Leopold). Further necrosis and increased cellular infiltration of iris. 5 days.

gone and the stromal fibers have become hyalinized and structureless. It is at about the 48-hour stage that small vessels are first seen in the corneal substance near the limbus. In the 0.8 mg. lesion, vascularization beyond this point seems to be inhibited for, although the vessels can be found near the limbus throughout the course of the lesion, they never extend far toward the center of the cornea. In the 0.4 mg. lesion, on the other hand, vascularization is a prominent feature, and by three weeks vessels are still seen in all layers and in some cases, extend almost to the center of the cornea. In the 0.8 mg. lesion, loss of corneal substance through slough begins as early as 48 hours and increases rapidly so that some eyes perforate by the end of the first week, although most remain intact until the middle of the second week. No successful repair being accomplished, the eyes appear, at the

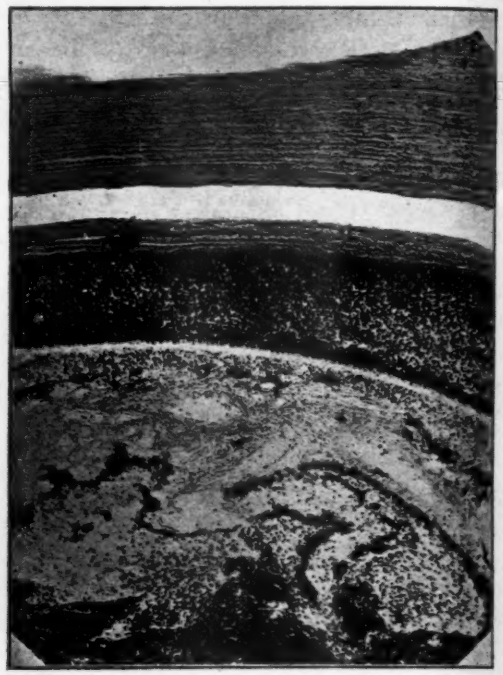

Fig. 13. (LaMotte and Leopold). Corneal slough in eye which has perforated. Necrosis and hyalinization of iris and ciliary processes. 8 days.

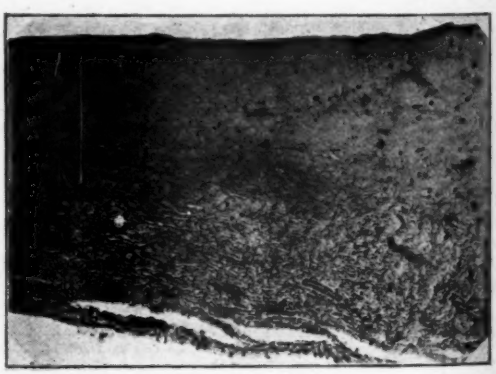

Fig. 14 (LaMotte and Leopold). Intact area of a perforated cornea showing regenerated epithelium overlying necrotic and hyalinized stroma. 12 days.

end of three weeks, as necrotic degenerated masses. After three weeks, the milder lesion presents an intact, but thickened, edematous, infiltrated, and vascularized stroma, with no stromal cells in evidence.

The most striking and most severe changes occur in the iris and ciliary body. By the end of six hours (fig. 3), edema and congestion are much more marked here than in the cornea, and by 12 hours (fig. 5), engorgement has become tremendous. At this time there is already evident slight damage to the endothelial cells of the uveal vessels, and some free hemorrhage into the edematous iris stroma. Likewise, protein material is seen by this time in the anterior chamber.

Fig. 15 (LaMotte and Leopold). Further necrosis of ciliary processes, iris, and cornea. 12 days.

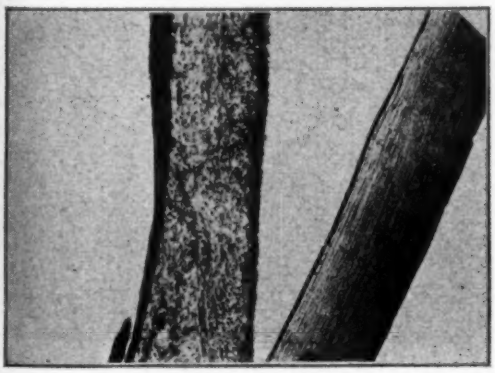

Fig. 16 (LaMotte and Leopold). Iris and cornea. No significant alteration in normal structure. 2½ hrs.

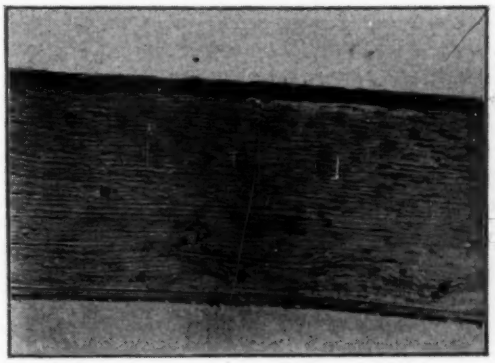

Fig. 17 (LaMotte and Leopold). Cornea. No significant change. 6½ hrs.

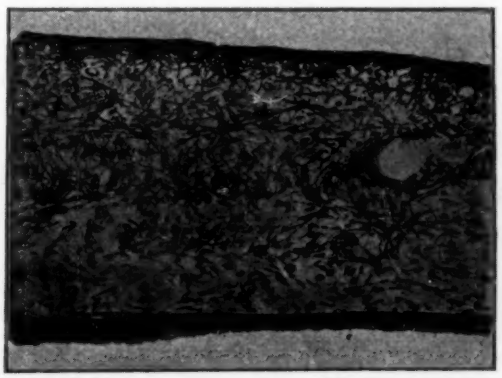

Fig. 18 (LaMotte and Leopold). Iris. No significant alteration from normal. 6½ hrs.

Necrosis of the iris becomes evident between 12 and 24 hours and, by 48 hours (fig. 9), has proceeded rapidly to the point where normal cellular structure is completely lost. The general architecture is barely recognizable because of the advancing hyaline degeneration, and the edematous, necrotic structure shows invasion by polymorphonuclear leukocytes and macrophages. This process continues unabated in the 0.8 mg. lesion so that by the end of three weeks the iris and ciliary body are but a scarcely recognizable part of the necrotic eye. Even in the three-week-old 0.4 mg. lesion, the process has been severe enough so that the anterior uveal structures have become hyalinized, rendered relatively avascular by the de-

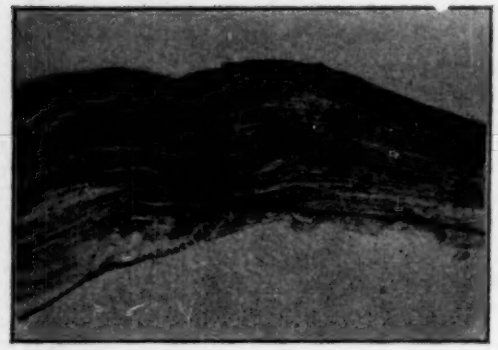

Fig. 19 (LaMotte and Leopold). 24 hrs.

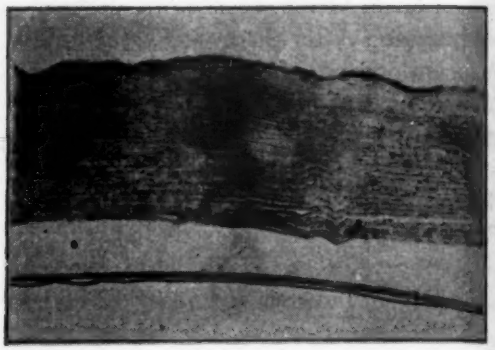

Fig. 20 (LaMotte and Leopold). Demonstrating loss of epithelium edema of stroma, pyknosis of normal cell nuclei, and intact nuclei. 24 hrs.

Fig. 21 (LaMotte and Leopold). Loss of epithelium. Breaking of stromal cell nuclei, infiltration of stroma, cells in anterior chamber and on posterior corneal surface, corneal edema. 48 hrs.

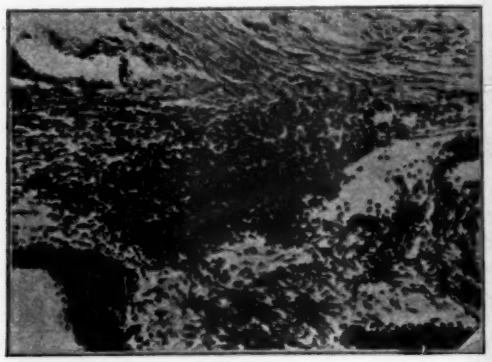

Fig. 22 (LaMotte and Leopold). Clumps of inflammatory cells—polymorphonuclears at angle of anterior chamber. 48 hrs.

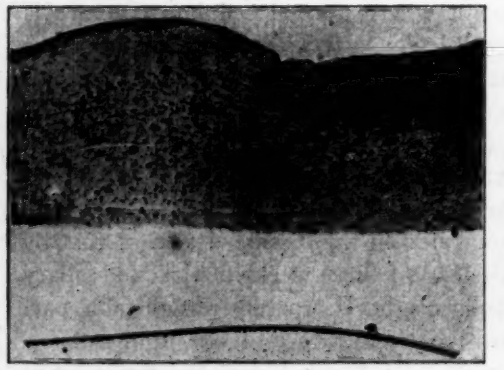

Fig. 23 (LaMotte and Leopold). Corneal inflammatory cell infiltration, corneal edema, necrosis of stromal cells. Intact Descemet's, endothelium showing edema. 96 hrs.

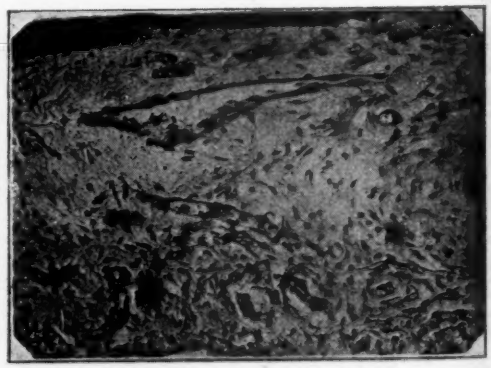

Fig. 24 (LaMotte and Leopold). Iris showing edema. 96 hrs.

Fig. 25 (LaMotte and Leopold). Exudate in anterior chamber, partial loss of endothelium. Continued corneal infiltration—iris slight edema. 5 days.

Fig. 26 (LaMotte and Leopold). Showing regenerating corneal epithelium at another site than that demonstrated in figure 25. 5 days.

Fig. 27 (LaMotte and Leopold). Cornea showing vascular and cellular infiltration of stroma, loosely attached regenerating epithelium, intact Descemet's, and endothelium. 10 days.

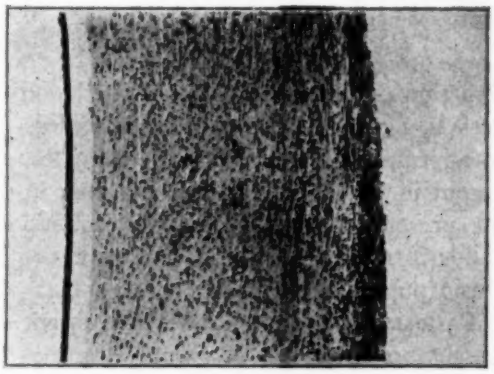

Fig. 28 (LaMotte and Leopold). Another site of cornea seen in figure 27. Diffuse stromal infiltration with dense staining in superficial area. 10 days.

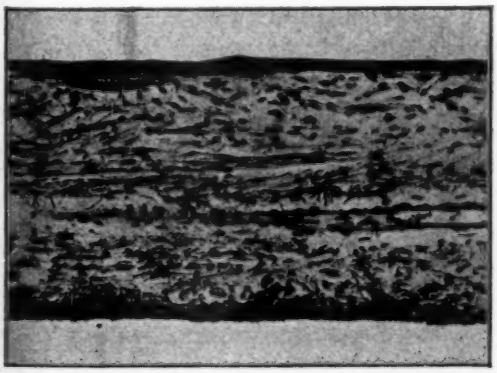

Fig. 29 (LaMotte and Leopold). Iris showing practically no alterations from normal except slight edema. 10 days.

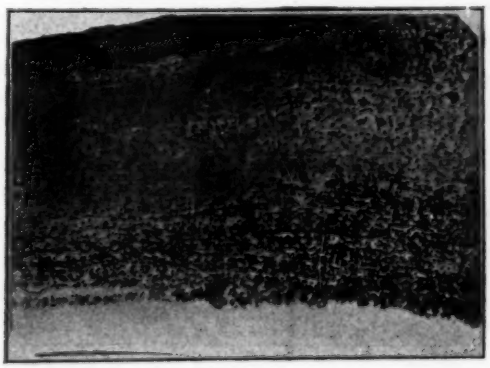

Fig. 30 (LaMotte and Leopold). Superficial slough; diffuse infiltration of inflammatory cells, vessels and fibroblasts; marked thickening of cornea; intact endothelium and Descemet's. 10 days.

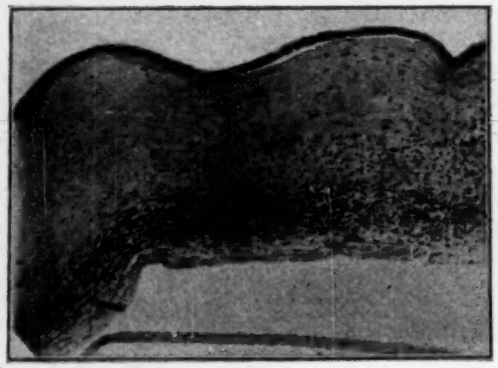

Fig. 31 (LaMotte and Leopold). Same cornea as figure 30—different site. Showing absence of superficial stromal cell nuclei, regenerating epithelium loosely attached, posterior infiltration, intact endothelium. 14 days.

struction of the endothelium of the blood vessels, necrotic and functionally useless in appearance. Yet reparative processes, absent in the 0.8 mg. lesion, are seen in the presence of well-formed fibroblastic bands forming anterior synechiae and occlusio pupillae.

Posterior segment changes are absent except for the expected events in an endophthalmitis accompanying the more advanced and severe stages of the lesions just described.

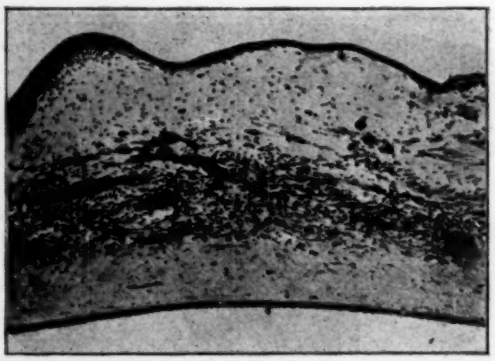

Fig. 32 (LaMotte and Leopold). Regenerating epithelium, edema of superficial stroma, vascularization and cellular infiltration (small round cells and polymorphonuclear cells) chiefly in mid-stromal zone. Intact Descemet's and endothelium. 33 days.

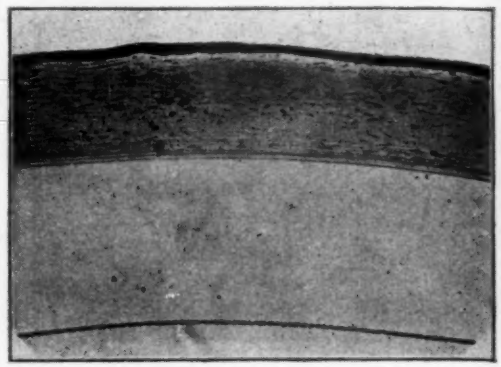

Fig. 33 (LaMotte and Leopold). Intact cornea of normal thickness with no infiltration, vascularization or alteration in normal corneal histology. 16 mos.

HN_3 EYES

The conjunctiva following exposure to HN_3 liquid burns shows, histologically, edema and mild inflammatory cell infiltrations. This change is first noted by 2½ hours after exposure, and the entire process is gone by one month, leaving practically no permanent damage. The limbal region reveals signs of moderate congestion, and inflammatory cell infiltration is also present by 2½ hours, increasing in amount for the first 10 days. The inflammatory cells at first are eosinophilic-staining polymorphonuclear cells, but by the 14th day small round cells are also pres-

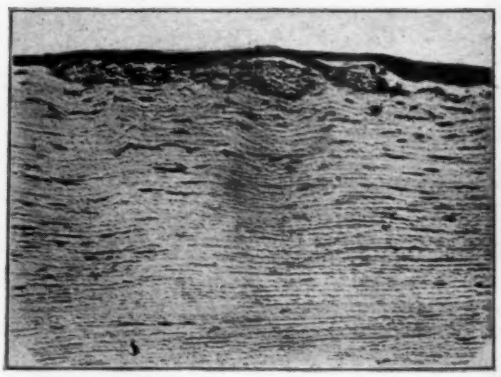

Fig. 34 (LaMotte and Leopold). Same cornea as figure 33 at site of only histologic evidence of damage, showing superficial vessels. 16 mos.

ent. The limbal changes disappear completely after one month.

There is very little evidence of corneal change before 24 hours, at which time areas of epithelium (fig. 19) have been lost, although the basal cells are not at first included. Later, however, complete denudation may occur. Edema of the corneal stroma and death of some of the stromal cells also begin by 24 hours. By 48 hours, these changes have increased, and polymorphonuclear cell infiltration of the stroma has begun. By the fourth day, the greatest degeneration of stromal substance is present superficially (fig. 23). The corneal endothelium remains intact except for local cell swelling until the fifth day, when small areas are lost. At this time, the epithelium has begun to regenerate. Vessels have invaded the stroma by the 10th day, lying chiefly in the midstromal zone, although a few are superficially situated. Repair of the stroma by young fibroblasts is also under way by the 10th day, and by the end of two weeks the endothelium is again intact. Vessels and cellular infiltration are still present after one month (fig. 32), and occasional bullae may be found at this time. After about a year, the cornea has largely recovered except for areas of superficial stromal vascularization (fig. 34).

The only change noted in the iris is mild edema starting about two days after exposure. Very little congestion or cellular invasion of the iris ever appear. The anterior chamber shows only a mild exudate around the second day which disappears without sequellae by the 10th day (figs. 18, 24, 29).

Discussion

Liquid HN_2 produces severe ocular damage, an 0.8 mg. lesion resulting in a perforated and lost eye. The milder dose of 0.4 mg. produces severe necrosis of the cornea, but does not prevent reparative processes from gaining a foothold. Yet at three weeks, the extent of the vascularization appears to be defeating its purpose and instead contributes to the loss of function of this tissue. It is quite evident that HN_3 produces definite corneal changes but, in most instances, the damage is not irreparable. The vascularization here is chiefly of the deep type, and most of these vessels may disappear. The superficial vascularization noted after one year may be related to the bullae previously present. The chief difference between the action of the two vesicant agents is in the changes which they produce in the iris and the ciliary body. Whereas, in HN_3 burns the process never goes beyond the stage of edema, mild congestion, and very slight cellular infiltration, with subsequent complete return to normal histology, the process in HN_2 burns is one of severe necrosis of anterior uveal tissue, degeneration, and loss of function to the extent that any return to normal appears impossible.

The work of Scholz[4] on the pathology of HN_2 lesions resulted in essentially the same conclusions, although the material studied was obtained from less severe lesions produced, in most instances, by vapor rather than liquid vesicant agents. Maumenee[5] compared the histopathology of the ocular lesions produced by these two nitrogen mustards and, in addition, a third nitrogen mustard known as HN_1, together with mustard itself, and concluded that all the lesions were so similar that it was impossible to differentiate one from the other histologically except for the depth of the damage done; the damage to the deeper tissues being greatest with HN_2, intermediate with HN_3, and least with HN_1 and mustard.

Summary

1. The histopathologic changes in the rabbit eye due to liquid preparations of the

nitrogen mustards HN_2 and HN_3 are presented and compared.

2. The changes resulting from HN_3 are relatively mild and, in the dosage used, do not preclude recovery.

3. The changes resulting from HN_2 are severe and frequently result in the complete destruction of the eye.

4. The same major histologic events occur in lesions produced by both of these vesicant agents, the chief difference resting in the degree of damage occurring in the anterior uveal structures.

36th and Spruce Streets (4).

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EFFECT OF OILY DROPS ON EYES EXPOSED TO MUSTARD VAPOR*

GEORGE I. UHDE, M.D.

Portland, Oregon

AND

E. B. DUNPHY, M.D.

Boston, Massachusetts

During the recent war, it was frequently stated that oily drops should never be used in an eye which might be exposed to mustard vapor. The reason given was that mustard, being soluble in fat might concentrate in the oily drops resulting in a serious eye burn. That this did not seem probable to us was shown by the fact that, experimentally, a paraffin-liquid mustard droplet caused a milder lesion on a rabbit's cornea than a pure mustard droplet of equal strength. Furthermore, Sollman,[1] in 1919, had shown that certain oily substances, such as linseed oil and cod-liver oil, had a definite prophylactic effect against mustard on the skin.

The following experiments were undertaken to ascertain the truth of the matter and, now that security regulations have been lifted, it was thought advisable to put our conclusions on record.

EXPERIMENTS ON RABBITS

METHODS AND RESULTS

EXPERIMENT 1

Two drops of Radiostol (irradiated ergosterol, British Drug Houses), which has a peanut-oil base, were instilled into the right eyes of six rabbits immediately prior to, and at the mid-point of, an exposure to 4 mg./m³ of mustard vapor for 3½ hrs. (Ct† 840). The left eyes were left untreated as normal controls.

* The authors completed this work while attached unassigned as experimental officers in ophthalmology to the Physiology Section (A. Fairley, head), Chemical Defence Experimental Station, Porton, England.

† Ct is a term used in chemical-warfare language to express unit dosage. Ct equals concentration of any gas times period of exposure in minutes.

Fig. 1 (Uhde and Dunphy). Both eyes were exposed simultaneously to 4 mg./m³ of mustard vapor for 3½ hours (Ct 840). Two drops of vitamin D in peanut oil were instilled into the right eye just prior to and at the midpoint of exposure. The left eye was an untreated control. This photograph was made at 72 hours.

The lids of both eyes were sutured open to prevent blinking. The eyes were examined by slitlamp at stated intervals thereafter.

There was a significant difference between the two sets of eyes even as early as 24 hours, the treated eyes showing much less irritation. By the third day, the treated eyes were quite normal; whereas, the untreated control eyes were not only congested, but also showed considerable corneal edema (fig. 1). By the 36th day, the corneas of three of the six untreated control eyes were scarred and vascularized.

Experiment 2

Under the same conditions as experiment 1, the right eyes of six rabbits were prophylactically treated with vitamin A in peanut oil.

At the end of 24 hours, the treated eyes were better in four rabbits (67 percent), and the same as the control eyes in two rabbits (33 percent). By the 36th day, three of the rabbits were dead, but the corneas of the remaining three untreated control eyes, were scarred and vascularized, while only one of the three treated eyes showed any abnormality—a slight nebular scarring.

Experiment 3

The right eyes of six rabbits were treated as in experiment 1, but with cod-liver oil. The exposure was increased to a dosage of (Ct 1,950).

At observation periods of 24 hours, 9 days, and 19 days, the treated eyes were consistently better than the untreated eyes in four rabbits (67 percent), and equal in two rabbits (33 percent). Two of the untreated eyes developed corneal vascularization by the 19th day.

Experiment 4

Forty-two rabbits were treated with various oily solutions as shown in the following table, and in the same manner as in experiment 1, but were exposed to an even higher dosage (Ct 2,520). In this case, although all eyes showed damage, the ones treated prophylactically with vitamin D in peanut oil were much less

severely affected than their untreated controls. Olive oil, liquid paraffin, and linseed oil all appeared to afford some measure of protection, also.

EXPERIMENT 5

Since vitamin D in peanut oil appeared to be the most effective of the various oily drops in protecting the cornea, the following experiment was done. The right eyes of two rabbits were treated with three drops of Radiostol just before exposure to a very heavy dosage (Ct 7,400). The left eyes were untreated. A specially designed type of respirator was worn to protect the breathing passages, but which left the eyes exposed. Special eye specula were used to prevent blinking.

At 24 and 48 hours there was very little difference between the treated and the untreated eyes. At 35 days the corneas of all eyes were severely scarred and vascularized.

The right eyes of two other rabbits were treated with three drops of Radiostol just after exposure to a dosage (Ct 7,400). The left eyes were untreated.

At 24 hours, 48 hours, and 35 days there was very little, if any, difference between the treated and untreated eyes, all eyes being severely damaged.

EXPERIMENTS ON HUMAN EYES

EXPERIMENT 6

Six volunteers with normal, healthy eyes were exposed to mustard vapor of an approximate dosage (Ct 90). All wore industrial-type respirators which protected the respiratory tract, but left the eyes exposed. Just before entering the gas chamber, each volunteer received two drops of either vitamin A in peanut oil or Radiostol in the right eye only, the left eye remaining as the control. All the volunteers eventually developed a mild chemical ophthalmia in both eyes characterized by conjunctival injection, grayish flecks in the corneal epithelium, photophobia, and lacrimation.

Daily examinations were made. The results are shown in table 2. While these two oils appear to have given slight protection to some of these human eyes ex-

TABLE 1

SHOWING THE PROPHYLACTIC VALUE OF OILY DROPS IN PROTECTING RABBIT EYES EXPOSED TO A (Ct) OF 2,520 OF MUSTARD VAPOR

Number of Rabbits	Treatment of Right Eyes	Treatment of Left Eyes	Comparison of Eyes at 24 Hours, 9 Days, and 19 Days after Exposure					
			Treated Eyes Better		Treated Eyes Equal		Treated Eyes Worse	
			No.	Percent	No.	Percent	No.	Percent
6	Vitamin D (peanut oil)	None	6	100				
6	Olive oil	None	4	66	2	33		
6	Liquid Paraffin	None	4	66	2	33		
6	Linseed oil	None	4	66	2	33		
6	Castor oil	None	3	50	3	50		
6	Vitamin A (peanut oil)	None	3	50	3	50		
6	Cod-liver oil	None	2	33	3	50	1	16

TABLE 2

SHOWING THE PROPHYLACTIC EFFECT OF OILY DROPS IN PROTECTING HUMAN EYES EXPOSED TO (Ct 90) OF MUSTARD VAPOR. RIGHT EYES TREATED WITH TWO DROPS OF EITHER VITAMIN A IN PEANUT OIL OR RADIOSTOL. LEFT EYES UNTREATED CONTROLS

Volunteer	Oil Used	Time Observed in Hours	Symptomatology and Signs															
			Grittiness		Photophobia		Lacrimination		Discharge		Injection		Flecks		Stain	
			O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.
A	Vitamin A oil	18	0	+	0	0	(+)	0	0	0	(+)	+	(+)	(+)	0	0
		42	0	+	0	0	0	0	0	0	0	(+)	(+)	(+)	0	0
		66	0	0	0	0	0	0	0	0	0	0	(+)	(+)	0	0
		90	0	0	0	0	0	0	0	0	0	0	(+)	(+)	0	0
B	"	18	0	+	0	+	(+)	0	0	0	0	0	(+)	+	0	0
		42	+	0	0	0	0	0	0	0	0	0	(+)	(+)	0	0
		66	0	0	0	0	0	0	0	0	0	0	(+)	(+)	0	0
		90	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	"	18	+	+	(+)	(+)	0	0	0	0	+	+	+	+	0	0
		42	0	(+)	(+)	(+)	0	0	0	0	(+)	(+)	++	++	0	0
		66	0	0	(+)	(+)	0	0	0	0	(+)	(+)	+	+	0	0
		90	0	0	0	0	0	0	0	0	0	0	(+)	(+)	0	0
D	Radiostol	18	0	+	0	+	0	0	0	0	+	++	(+)	(+)	0	0
		42	0	(+)	0	0	0	0	0	0	(+)	+	+	+	0	0
		66	0	(+)	0	0	0	0	0	0	0	0	+	+	0	0
		90	0	0	0	0	0	0	0	0	0	0	(+)	(+)	0	0
E	"	18	+	+	+	+	0	0	0	0	+	+	+	++	0	0
		42	0	(+)	(+)	(+)	(+)	(+)	0	0	(+)	+	+	+	0	0
		66	0	0	(+)	(+)	0	0	0	0	(+)	(+)	+	+	0	0
		90	0	0	0	0	0	0	0	0	(+)	(+)	(+)	(+)	0	0
F	"	18	0	0	(+)	(+)	+	+	+	+	+	+	(+)	(+)	0	0
		42	0	(+)	0	0	0	0	0	0	0	+	+	++	0	0
		66	0	0	0	0	0	0	0	0	0	(+)	(+)	+	0	0
		90	0	0	0	0	0	0	0	0	0	0	(+)	(+)	0	0

(+) Practically normal
\+ Mild
++ Moderate
+++ Severe

TABLE 3

SHOWING THE THERAPEUTIC EFFECT OF OILY DROPS AFTER EXPOSING HUMAN EYES TO (CT 90) OF MUSTARD VAPOR. RIGHT EYES TREATED WITH EITHER TWO DROPS OF VITAMIN A IN PEANUT OIL OR RADIOSTOL THREE TIMES DAILY FOR FOUR DAYS AFTER EXPOSURE. LEFT EYES UNTREATED CONTROLS

Volunteer	Oil Used	Time Observed in Hours	Symptomatology and Signs													
			Grittiness		Photophobia		Tearing		Discharge		Injection		Flecks		Stain	
			O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.	O.D.	O.S
G	Vitamin A oil	18	+	+	++	++	++	++	0	0	+++	+++	++	++	0	0
		42	(+)	(+)	+	+	+	+	0	0	++	++	+++	+++	0	0
		66	0	0	0	0	0	0	0	0	(+)	(+)	++	++	0	0
		90	0	0	0	0	0	0	0	0	0	0	+	+	0	0
H	"	18	+	+	+	+	+	+	0	0	++	++	+	+	0	0
		42	+	0	0	0	(+)	(+)	+	0	+	0	++	++	0	0
		66	(+)	(+)	(+)	(+)	(+)	(+)	(+)	0	+	0	++	++	0	0
		90	0	0	0	0	0	0	0	0	0	0	+	+	0	0
I	"	18	0	+	+	+	(+)	(+)	0	0	+	+	(+)	(+)	0	0
		42	(+)	(+)	(+)	(+)	0	0	0	0	(+)	(+)	+++	+++	0	0
		66	(+)	(+)	(+)	(+)	0	0	0	0	(+)	(+)	++	++	0	0
		90	0	0	0	0	0	0	0	0	0	0	+	+	0	0
J	Radiostol	18	+	++	+	++	0	0	0	0	++	++	+	+	0	0
		42	+	+	(+)	(+)	(+)	(+)	0	0	+	+	+	+	0	0
		66	(+)	(+)	(+)	(+)	0	0	0	0	+	+	+	+	0	0
		90	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K	"	18	++	+	+	+	+	+	0	0	++	++	+++	+++	0	0
		42	+	++	++	++	+	+	0	0	+++	+++	++++	++++	0	0
		66	++	(+)	++	+	++	+	0	0	++	+	+++	+++	0	0
		90	(+)	0	0	0	0	0	0	0	0	0	++	++	0	0
L	"	18	+	++	(+)	+	+	(+)	0	0	++	++	+	+	0	0
		42	(+)	+	(+)	(+)	(+)	(+)	0	0	+	+	++	++	0	0
		66	+	(+)	(+)	(+)	(+)	(+)	0	0	+	+	+	+	0	0
		90	0	0	0	0	0	0	0	0	(+)	(+)	0	0	0	0

(+) Practically normal
\+ Mild
++ Moderate
+++ Severe
++++ Very severe

posed to a dosage (Ct 90), the results cannot be called significant as was the case in the rabbits exposed to a dosage (Ct 840). However, it is certain they did not have a deleterious effect, as frequently predicted.

Experiment 7

Under the same conditions as those of experiment 6, another group of six volunteers was exposed to an approximate dosage (Ct 90). However, prophylactic treatment was not given this group, but instead, upon emerging from the gas chamber, each man had two drops of either vitamin A in peanut oil or Radiostol instilled into the right eye, the left eye remaining untreated as the control. The right eyes were treated with these oils three times daily for the next four days. The treated and untreated eyes were compared at various intervals to see if any difference could be noted. All the men developed mild chemical ophthalmia as in experiment 6.

Results are shown in table 3. There were no essential differences between the treated and untreated eyes.

Conclusions

One eye of each of 64 rabbits was treated with various oily drops just prior to and during exposure to mustard vapor, dosages (Ct) varying between 840 and 7,400. The opposite eye was untreated and used as a control. It was found that the lesions of the treated eyes were less severe in 40 rabbits (62.5 percent), equal in 23 rabbits (36 percent), and more severe in one rabbit (1.5 percent). When the dosage (Ct) was 840, complete protection in the treated eyes was obtained with Radiostol (peanut-oil base). Even with dosages (Ct) as high as 2,520 most of the oily drops used appeared to give a certain degree of protection to the cornea. When the dosage (Ct) was very high (7,400), there was very little, if any, difference between the treated and the untreated eye, all being severely damaged.

Twelve human volunteers were exposed to mustard vapor, dosage (Ct 90). One eye of each volunteer was treated with oily drops either before or immediately after exposure, the opposite eye serving as a control. Vitamin A, in peanut oil, or Radiostol instilled into six eyes before exposure did not significantly influence the degree of the lesion produced. Vitamin A, in peanut oil, or Radiostol instilled into six eyes three times daily for four days following exposure did not appear to delay normal recovery.

It seems obvious from these experiments that the current belief in the danger of using oily drops in the treatment of eyes exposed to mustard-gas vapor is unfounded.

3181 S.W. Marquam Hill Road.
243 Charles Street (14).

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SEED GRAFTING OF THE CONJUNCTIVA IN THE TREATMENT OF SYMBLEPHARON

A. HAGEDOORN, M.D.
Amsterdam, Holland

In November, 1928, the right eye of F. G. was severely damaged by an accident in which molten iron entered the conjunctival sac. Treatment could not prevent severe scarring of the cornea, complete symblepharon of the inferior eyelid, and other cicatrices in the superior cul-de-sac (fig. 1). On February 2, 1929, and on February 1 and April 4, 1930, plastic operations were performed elsewhere, but the result was poor, and on September 27, 1930, a total blepharorrhaphy was done.

Figs. 1-3 (Hagedoorn). Symblepharon before and after seed grafting of the conjunctiva.
Fig. 1, Symblepharon, previous to the plastic operation beginning February 2, 1929.
Fig. 2, Appearance of the eye 17 days after the operation on April 22, 1941. The palpebral fissure has been reopened the (stents) mold is visible.
Fig. 3, The eye has been fitted with a colored contact glass (March 10, 1942).

When I saw the patient, he believed the right eye to be blind but complained of the cosmetic aspect of the blepharorrhaphy. The ordinary procedures did not seem advisable, the less since they had proved a failure in this case in the hands of an experienced ophthalmic surgeon.

Thin Ollier Thiersch dermo-epidermic grafts, with their whitish discharge give poor results; and, although I have had good results in some cases, mucous-membrane transplants are by no means ideal (Hughes[1]). In studying this case, I came on an interesting technique described by Horsley.[2]

The pinch graft is a procedure devised by Braun and Wagenstein and developed by J. Staige Davis. The latter "uses a straight intestinal needle held firmly in a straight-nose hemostat and, after the point of the needle is introduced into the epidermis, it is raised, producing a small cone of skin. The base of the cone is cut through with the down-turned blade of a sharp knife. The grafts are somewhat universally, although erroneously, called pinch grafts, since they are originally cut by pinching a cone of skin with tissue forceps and cutting off the base with scissors. This particular technique should be abandoned since the tissue forceps and the scissors produce too much trauma." Since the name "pinch graft" is in contradiction to the major rule of plastic surgery that a transplant should be handled as delicately as possible, the conjunctival variety of the porcedure was called "seed grafting."

OPERATION

The patient was operated on on April 22, 1941. The palpebral fissure was reopened. The inferior part of the cornea was found to be leukomatous and covered by connective tissue, although free from

the eyelids. The superior part was clear; the pupil very narrow with seclusio pupillae. The patient proved to have definite perception of light; even the direction from which the light came was recognized. There was, consequently, no indication for enucleation.

The symblepharon of the inferior eyelid with the sclera began at about the region of the limbus corneae and was complete, extending from the outer to the inner canthus. The margin and body of the lid for its entire length were inseparably attached to the scleral wall of the eye.

It proved somewhat difficult to free both structures, and a pigmented area was found on the bulbus at the site of a perforation from a former operation. After the inferior eyelid had become freed of the eyeball, it proved to be of about normal thickness, so that no connective tissue had to be resected. The tissues were divided beyond the region of the inferior cul-de-sac down to the inferior bony margin of the orbit in view of the unavoidable postoperative shrinkage.

The superior cul-de-sac was inaccessible because of some bands of connective tissue separated by crypts. The situation now revealed itself to be far worse than could be inferred from the case history of 1930.

The bands were cut or resected, and a new superior cul-de-sac was made, care being taken not to go too far upward and damage the levator palpebrae muscle. Near the margin of the inferior eyelid, eight sutures were placed through the skin. When artery forceps were fixed to these sutures, they pulled the inferior eyelid downward, disclosing and exposing its bare inner surface. These sutures were also indispensable in inserting the mold at a later stage of the operation. For the same reason three sutures were placed near the margin of the superior eyelid. Finally, a large canthotomy was performed, and the hemorrhage that followed carefully controlled.

The sutures were relaxed, and a form of dental wax (stents) was molded to fit the newly formed conjunctival sac, now denuded of conjunctiva. The central part of mold was made more concave than the curvature of the cornea so that it could not touch and damage its surface. A small hole in the center, 5 mm. in diameter, made observation of the cornea possible during aftertreatment, as soon as the palpebral fissure was reopened (see later). Care was taken that the mold fitted the cavity as accurately as possible and that the eyelids could be closed over it without any tension. The margins of the mold were made rather thick in anticipation of the considerable postoperative shrinkage of the cavity. Hemorrhage was carefully controlled, and tears were prevented from flooding the receptive area by strips of gauze. Lacrimation was moderate, although, fortunately, not absent. The mold was wrapped in sterile gauze and laid aside.

In the next stage of the operation, artery forceps were fixed to the sutures of the inferior eyelid, pulling it downward by their weight and exposing the inner surface, completely devoid of epithelium. The superior eyelid was fixed in a tarsus-clamp forceps, everted so that the normal, tarsal-conjunctiva donor area was revealed. A fine needle was introduced into this conjunctiva; it was raised, but because of the firm fixation of the conjunctiva to the underlying tarsus, the movement was very limited. Consequently, only a very small cone of conjunctiva was obtained; this was cut with a razor blade. This technique was ideal, but it was much easier to snip the small cone off with iris scissors. These small conjunctival snips were grafted on the inner surface of the inferior eyelid and against the eyeball itself, in its inferior

half. Other conjunctival grafts were snipped from any area where a conjunctival lining was present. All these grafts were carefully transplanted, one by one, directly from donor area to the receiving surface. Gentle pressure was applied by a cataract spatula so as to flatten out the grafts and remove excess blood, or serum, and tear fluid. After the last graft had been placed in position, the wound was allowed to dry for a few minutes. The grafts adhered quite well to the underlying tissue. The mold was now reinserted, care being taken to displace as few of the grafts as possible. The sutures of the superior and inferior eyelids were helpful in inserting the mold and in closing the eyelids over it, leaving the tiny grafts *in situ*. The traumatized surfaces of the margins of the eyelids, caused by the cleavage of the blepharorrhaphy in the first stage of the operation, were sutured again.

Figure 2 was taken 12 days after the operation, after the palpebral fissure was reopened. The mold is clearly visible. It was removed on the fourteenth day. On the temporal side, the result was far better than I had expected. However, at the extreme nasal side, in the region of the canaliculus, where the cul-de-sac was very shallow, the result was not so good. This was due to the fact that we failed to free the bulbus sufficiently at this spot and at the whole nasal side under the caruncula lacrimalis. Consequently, the movements of the eye toward the temporal side were still restricted, whereas they were excellent in all other directions. In the future, sufficient freeing of the bulbus will not be neglected. To do this will require more conjunctival grafting, but there seems to be little objection to taking some grafts from the conjunctiva of the other eye, especially in cases where vision is good and limitation of ocular movements would cause trouble. This could be attempted in new cases in the granular stage.

Recovery was uneventful. Probably because of the ideal physiologic nature of the grafts, there was very little secretion. Nineteen days after the operation, the patient was able to return to work. In the right eye he had light perception and even accurate projection. He was very glad to know that he could see with this eye and that he would be even better off if an operation were performed (iridectomy). However, binocular vision was under this disadvantage: The image of the normal left eye was disturbed by the blurred, distorted, obliquely placed image superimposed upon it by the right eye; a disturbance which probably would be increased if an iridectomy were performed, causing the image of this eye to become more obtrusive. Moreover, the cosmetic effect was unsatisfactory, since dense scar tissue made the inferior part of the cornea whitish.

For these reasons, the original procedure, determined upon prior to the operation, was carried out, and a colored contact glass was inserted. The results, both subjective and objective, were good (fig. 3). The patient has to be content with the knowledge that, should his left eye be lost by another accident, he would be able to help himself with the right eye, now excluded from use.

Summary

Treatment of a case of total symblepharon of the inferior eyelid is described. By means of small "seed" grafts from the conjunctiva of the same eye, in combination with a (stents) mold and a contact glass, the results are as illustrated in figure 3.

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IMPLANTATION INTO TENON'S CAPSULE*

SIDNEY A. FOX, M.D.
New York

It is generally accepted by ophthalmologists that, when an eye has been removed, the socket for both physiologic and cosmetic reasons should have some sort of an implant. This concept has been so well established that it requires no documentation. Nor is there any intention to discuss here the respective merits of the various shapes, sizes, and materials used for this purpose. My aim here is to report the method used and the results obtained in making a large series of implants because it is probable that the experiences of ophthalmic surgery in war will be of interest to all ophthalmologists.

In the 22-month period from February 1, 1944, to November 30, 1945, there were 144 implantations into Tenon's capsule at this hospital. Of these, 67 immediately followed enucleation. The other 77 were delayed or secondary implants for sockets from which the eyes had been removed overseas from 3 to 14 months earlier. None were lost.

In the first 27 cases Mule's vitreous spheres were used. Tenon's capsule was closed with a 3-0 chromic purse-string suture, and the conjunctiva was closed with a 4-0 black-silk interrupted stitch. In all subsequent cases, a plastic-ball implant was used exclusively, made of the material that was used by the Army in the manufacture of plastic-eye prostheses, a polymer of methyl methacrylate. In these latter cases also, the crossed mattress suture much as described by Kirby[1] was used to close Tenon's capsule and a running black-silk suture was employed for conjunctival closure. In the vast majority of cases, the 16 mm. ball was used. This is an unpolished, solid plastic ball with small round indentations as illustrated (fig. 1). In only seven cases was either an 18 mm. or 14 mm. implant used. The weight of the ball is approximately three times that of the homologous glass sphere. No untoward reactions to the plastic material were noted. Some of these cases were under observation for 12 months or longer.

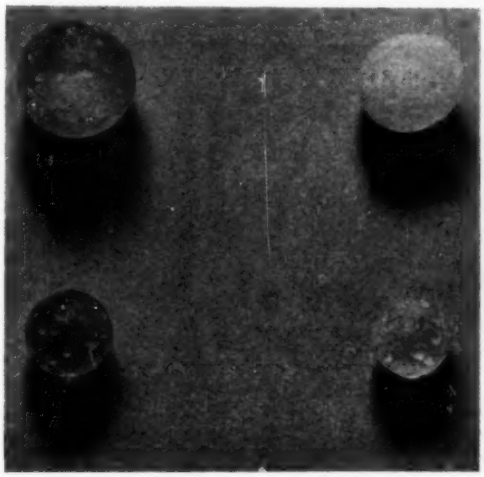

Fig. 1 (Fox). Plastic balls used for implantation into Tenon's capsule. The sizes are 18, 16, 14, and 12 mm.

TECHNIQUE

Enucleations. The patient is given 1.5 gr. of nembutal the night before operation. In the morning 4.5 gr. of sodium amytal is given one hour preoperatively. Just before the patient is wheeled into the operating room, morphine sulphate (0.25 gr.) together with 1 c.c. of prostigmine methylsulphate (1:2,000) is administered intravenously. As shown by Slaughter,[2] prostigmine has been found to enhance the action of the morphine. Locally the eye is anesthetized by a 0.5-percent instillation of pontocaine and a retro-

*From the Eye Center, Newton D. Baker General Hospital, Martinsburg, West Virginia.

bulbar injection of 4 c.c. of 1-percent novocaine with adrenalin. More may be given if necessary. The latter anesthetic is also used to balloon up the conjunctiva. This combination has worked so well that general anesthesia has been found unnecessary.

The conjunctiva is circumcised close to the limbus and undermined into the fornices and canthi. The four rectus muscles are isolated on a muscle hook and cut close to the sclera at their insertions with a minimum of surgery and without freeing their fascial attachments. An exception to this is made in the case of the external rectus, a 4 mm. stump of which is left attached to the sclera and clamped in a small hemostat to facilitate subsequent handling of the globe. The blepharostat is then placed under the conjunctiva, and the globe proptosed. At this time, the oblique muscles are identified and cut close to the sclera, and all other adhesions to the sclera cut as far back as can be reached. The wire loop of a tonsil snare is then passed over the globe, tightened, and pressed downward. At the same time, an assistant pulls the globe upward by making traction on the hemostat attached to the stump of the external rectus muscle, and the eye is cleanly enucleated.

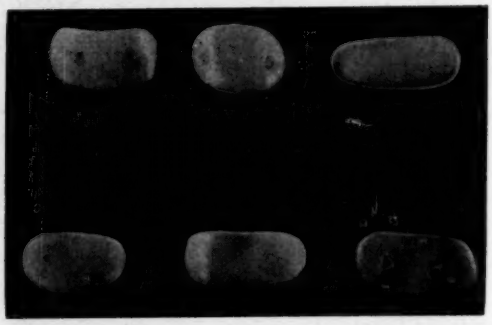

Fig. 2 (Fox). Type of conformers placed into conjunctival sac postoperatively. At first two holes were drilled in them for drainage. This was discontinued when it was found that the conjunctiva tended to protrude through these openings.

Hemostasis is obtained by a gauze strip folded into Tenon's capsule and by digital pressure.

The edge of Tenon's capsule is then grasped by four mosquito clamps opposite the insertions of the rectus muscles. Two double-armed mattress sutures of 3-0 chromic catgut are passed through the edge of Tenon's capsule from below upward diagonally as follows:

From the angle between the external and inferior recti to the angle between the internal and superior recti. And from the angle between the internal and inferior recti to the angle between the external and superior recti. A 16 mm. plastic ball is then inserted into Tenon's capsule by means of an introducer, and the sutures firmly tied. The conjunctiva is closed in the horizontal meridian by a 4-0 black-silk running suture knotted at both ends. A slightly curved plastic conformer (fig. 2) with the concavity inward is inserted, and a monocular pressure bandage applied.

The patient is kept in bed for 24 hours. The bandage is removed on the fifth postoperative day, the socket cleansed, the conformer reinserted, and a simple patch reapplied daily for two or three more days. A conformer is worn in the socket until a permanent prosthesis is obtained three or four weeks later.

Secondary orbital implants. Preoperative preparation and anesthesia is exactly the same as for enucleation. Due to the large amounts of fibrous tissue sometimes encountered in traumatic cases, more retrobulbar anesthesia is often necessary. The conjunctiva is opened horizontally in midline and undermined. After identification, a similar opening is made into Tenon's capsule and enlarged with scissors until good exposure is obtained. A large Kelly clamp is then inserted and opened gently so that Tenon's capsule is stretched sufficiently to assure adequate

space for the implant. This is important. From here on, the technique is the same as described above for enucleations.

Discussion

So many implants into Tenon's capsule without extrusion are hard to attribute to any one factor. There is nothing particularly new in any single step of the above outlined technique. As a matter of fact, due to the pressure of work the simplest and shortest procedures were adopted early as time savers. Thus the purse-string was discarded for the simpler, crossed mattress suture for closing Tenon's capsule; the interrupted suture for closing the conjunctiva was abandoned in favor of the simpler running suture. Parenthetically, it might be stated here that motility of the stump—or the lack of it—did not seem to be influenced by the type of closure used. In the case of enucleations, the use of the snare instead of the standard enucleation scissors is, I believe, an important factor. The advantage of using the snare is that it crushes the optic nerve and its vessels instead of cutting them cleanly and thus facilitates hemostasis and obviates secondary hemorrhage. Ophthalmologists who have not used this method of amputating the globe will be agreeably surprised by the minimal amount of bleeding in most cases.

In the case of secondary orbital implants, a factor which cannot be stressed too much is the use of sufficient dissection to give the implant ample room. Another important factor, in both enucleations and secondary implants, is the use of a conformer in the socket in conjunction with a firm pressure dressing which is undisturbed for five days. As shown in figure 2 this conformer varies in shape from the one first reported by Gifford[3] for this purpose. The effect, however, is the same, and my experience fully corroborates Gifford's opinion that postoperative chemosis is reduced by its use.

I do not believe that the kind of implant or sutures used makes much difference in retention of the implant.

Conclusions

1. In the 144 cases reported I believe that the factors preventing extrusion of the implant from Tenon's capsule after enucleation were: (a) use of the snare instead of the scissors for amputating the globe, (b) use of a conformer together with a firm pressure bandage which is undisturbed for five days. The latter prevents chemosis and assures healing of tissues in proper position.

2. In the case of secondary orbital implants, another factor is important: Sufficient dissection to assure that the implant has ample room in Tenon's capsule and does not have to be forced in.

3. I do not believe that the type or shape of implant used, nor the kind of suture, are of much importance in retention of an implant.

Recent advances in techniques will undoubtedly pave the way for ultimate improvement in type, quality, and mobility of orbital implants and prostheses, especially following immediate enucleation. But for some time to come, and until newer procedures are perfected, the method outlined above will be found adequate and effective.

63 East Seventy-fifth Street (21).

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NOTES, CASES, INSTRUMENTS

ORBITAL CELLULITIS FOLLOWED BY TOTAL BLINDNESS

HUGH C. DONAHUE, M.D.
Boston, Massachusetts

The orbit is the site of various pathologic processes, the most common of which are inflammation and neoplasm in addition to diseases which produce changes in position of the eyeball (exophthalmos and enophthalmos). Trauma, emphysema, extension of infection from the adjacent sinuses and eyelids, blood dyscrasias, and infections of Tenon's capsule may produce orbital change. The literature is replete not only with descriptions of the manner in which all of these disease processes may affect the orbit but also with reports of their results and complications. This report will attempt to describe a sequence of events which resulted in total blindness in an eye, surrounded by massively infected orbital tissues and accompanied by tremendous edema and proptosis, and to record my impression as to why total blindness ensued.

A review of the literature reveals that in many instances blindness or partially reduced vision was the aftereffect of various lesions occurring in the orbit. Complications of neoplasm, trauma, infections, emphysema, exophthalmos, and operative interference during the process of treatment have all been cited as predisposing causes of loss of vision but the actual sequence which led to the visual loss has frequently been concealed behind a cloud of generalities. Thrombophlebitis of the orbital blood vessels and excessive stretching of the orbital portion of the optic nerve due to extrinsic pressure on the nerve from surrounding pathologic processes have often been terms used to give a vague description of the succession of conditions leading to visual loss.

In the case to be discussed, I was able to observe accurately the sequence of events which I believe produced blindness and the intraocular changes which followed. It would be appropriate, however, first to review some of the causes of orbital cellulitis and the pathologic changes that occur.

This clinical entity is usually unilateral and is most commonly due to infection extending from accessory-nasal-sinus disease or infections of the eyelid extending to the orbital tissue through the blood and lymph vessels. The ethmoid and fronto-ethmoid cells are the most commonly involved sinus areas. Inflammation of the orbit may also result from a thrombophlebitis of the facial vein following infections of the eyelid, eyebrow, lip, and nose. Because of the anastamoses that occur between the veins of the superior maxilla, the mouth, tonsils and pharynx, and the deep orbital veins, extension of infection of these tissues to the orbit may easily result. Metastatic abscess of the orbit frequently arises in infectious diseases such as scarlet fever, chicken pox, and influenza. Tuberculosis of the periosteum may produce orbital cellulitis even in the absence of a break in the skin, and subperiosteal abscess following fracture, injury, or operation may also account for it. The pathologic changes that occur in this disease are inflammatory edema, congestion, stasis, and cellular infiltration with or without suppuration. All of these pathologic conditions occur in orbital phlegmon, orbital thrombophlebitis, subperiosteal abscess, and inflammation in Tenon's capsule.

Orbital cellulitis must be differentiated from cavernous-sinus thrombosis, which is usually bilateral, with marked constitutional symptoms and often accompanied by 3rd-, 4th-, and 6th-nerve paralysis; from serous tenonitis, which is usually bilateral, with severe pain and chemosis but with absence of constitutional symptoms; from panophthalmitis, which always includes involvement of the interior eye; and also from erysipelas, actinomycosis, and other infections.

In the case to be recorded, there occurred a primary infection of a lower lid which resulted in an extremely virulent infection of the intraorbital tissues, producing extreme edema of the lids, chemosis, exophthalmos, and limitation of motion of the eyeball. The patient's vision remained unaffected by all these changes until one morning in the second week of his disease when he noted a distinct and substantial loss of sight while testing his vision. Examination revealed no change in the external appearance of the eyeball from the previous day. There was marked exophthalmos and chemosis. The pupil was widely dilated due to mydriasis. The media were clear. However, the fundus showed the typical picture of embolism of the central retinal artery, with considerable edema of the macula, cherry-red spot, and attenuation of the retinal arteries.

The central artery of the retina, a very slender vessel about 0.25 mm. in. diameter, comes off the ophthalmic artery close to the optic foramen and is usually accompanied by another branch. It runs forward, first in or outside the dural sheath of the optic nerve, and then crosses the subarachnoid space with its vein and pierces the optic nerve on its inferior and medial aspect about 10 to 20 mm. behind the eye. Surrounded by an extension of pia mater and a sympathetic nerve plexus, it runs forward and upward in the axis of the nerve toward the lamina cribosa, which it penetrates to enter the eyeball. It then divides into two branches which lie in the nerve-fiber layer of the retina. All along its course, the central artery gives branches to the nerve and its coverings.

I believe that in this case there was no true embolism of the central retinal artery but that the extremely fulminating cellulitis of the orbital tissues produced so extreme an amount of edema, serous and cellular exudation, and congestion within the orbit that compression of the central artery took place. Obstruction of the blood flow was the result, causing the same clinical appearance of pathologic changes that accompanies embolism.

During the following days the usual sequelae took place; namely, slow and gradual subsidence of the area of edema and ischemia, with atrophy of the nerve head and constriction of the arteries. In my opinion this is probably the course of events that takes place in the majority of cases of orbital cellulitis which result in either blindness or substantially reduced vision and in which atrophy of the optic-nerve head has been reported.

Case report

Mr. A. C., aged 48 years, a married, American contractor, was first seen by me in January, 1943. At that time he complained of pain, irritation, and tenderness of the lower lid of the left eye of five days' duration. He had been previously seen by another ophthalmologist, who had treated him during the previous week for an hordeolum of this lid.

Examination proved the right eye to be entirely normal. In the left the vision was 20/20. The upper lid was moderately edematous, the lower lid extremely edematous, with brawny induration upon palpation. There was marked tenderness and

redness over the entire lower lid; and the palpebral and bulbar conjunctiva, especially in the lower area, were moderately congested. The cornea, pupil, iris, lens, vitreous, and fundus were normal. The intraocular pressure was normal, as were also the muscular excursions. A diagnosis of cellulitis of the lid was made, and immediate hospitalization advised.

The patient was admitted to the Massachusetts Eye and Ear Infirmary, where he was treated for two days with local applications of heat, and with various forms of local antisepsis together with local and systemic doses of sulfadiazine. During this period, penicillin was available in this hospital only to patients running a septic type of temperature. Upon the third hospital day, the edema of the lids increased, the chemosis of the bulbar conjunctiva was more severe, and there also was present a moderate degree of proptosis. Consultants in otolaryngology and infection were called, and it was deemed advisable to treat this patient with penicillin, even though the supply of this drug was being meticulously distributed. Incision through the upper lid into the superior orbit was also made upon two occasions, and small amounts of purulent material evacuated. Upon the fourth hospital day, the patient was running a septic type of chart. Intramuscular and intravenous injections of penicillin were commenced.

At this stage of the disease exophthalmos measured 7 mm. There was limitation of motion of the eyeball in all directions and marked edema and congestion of the lids and conjunctiva. The fundus was entirely normal other than a slight amount of venous congestion; vision was 20/20.

Upon the third day of penicillin therapy the septic material which had accumulated in the orbit became purulent, and there was profuse drainage of pus through the upper lid. This condition persisted for three days. Upon the second morning of such drainage, while the eyeball was considerably proptosed, the patient noted loss of sight. Examination of the fundus was made approximately two hours later and revealed the typical clinical picture of embolism or obstruction of the central retinal artery. There was massive edema of the macular area with ischemia and cherry-red spot; the arteries were constricted, the veins overfilled and tortuous. Vision was reduced to light perception.

It was obvious that the area of massive congestion and edema within the orbit had compressed the retinal artery, producing blockage of blood flow and secondary death of the ganglion cells of the retina. During the ensuing several days the infectious process gradually subsided, but the vision in this eye became nil, and the fundus showed the usual changes that occur following obstruction of the central retinal artery.

Two months following discharge from the hospital the patient's external eye was normal in every respect. There was no edema of the lids or conjunctiva. The eyeball had receded into its normal position, ocular movements were normal, as were also the cornea and iris. The pupil was moderately dilated and reacted sluggishly to light. The media were clear. The disc was snow white and atrophic, the macular area somewhat mottled and degenerated without edema. The arteries were threadlike in size and the veins slightly overfilled and tortuous.

It seems apparent that the loss of vision in this case (and probably in the majority of cases in which impairment of vision follows a condition that produces extreme congestion and edema within the orbit together with proptosis of the eyeball) was due to obstruction of the blood flow through the retinal artery brought about

by compression and constriction of this artery by external congestion and edema. This cessation of blood flow, verified clinically by the typical fundus picture, is a more logical explanation of the visual loss following orbital cellulitis than are other previously reported possibilities; namely, compression or stretching of the optic-nerve fibers alone.

520 Commonwealth Avenue.

REFRACTION CLINIC*

DISCUSSION BY ALBERT E. SLOANE, M.D.†
Boston

A woman, aged 49 years, came into the clinic complaining of having particular difficulty with prolonged near vision. She was wearing: O.D., +0.25D. sph. ⌒ −2.50D. cyl. ax. 115°; O.S., +0.25D. sph. ⌒ −2.25D. cyl. ax. 60°. Add +1.75.

On checking her refraction, very little difference from the glasses she had been wearing was found. It was noted that she had at: distance—5$^{\Delta}$ exophoria, v orthophoria; near—12$^{\Delta}$ exophoria, v orthophoria.

Uncorrected vision was: O.D., 20/50; O.S., 20/50. With the correction: O.D., +0.50D. sph. ⌒ −2.25D. cyl. ax. 115°, vision was 20/20; O.S., +0.50D. sph ⌒ −2.25D. cyl. ax. 60°, vision was 20/20. With the addition: +1.75D. sph., the patient could read well.

The house officer ordered a single-vision lens for near, incorporating a 2.50$^{\Delta}$ base in for each eye. The patient reported two months later, and stated that she was content with her new reading glasses and that she no longer had any discomfort with near vision. She would like to have this prescription incorporated into bifocals so that she can wear them constantly.

* From the House Officers' Teaching Clinic, Massachusetts Eye and Ear Infirmary.

† Director of Department of Refraction.

DISCUSSION

Before evaluating the indications for prisms in this case, it is well to consider the advisability of prescribing bifocals that contain prisms in their segments. It is usually better to avoid such a type of bifocals for four reasons: (1) Such glasses are more expensive than ordinary bifocals; (2) they are more conspicuous than ordinary bifocals; (3) most important, since the near vision is limited to the small segment of the bifocals and, thereby, requiring limited fixation be imposed on the eyes, such limitation may of itself contribute to the production of symptoms. The same prescription in a single-vision glass allows the patient to hold his book in many different positions and is less likely to bring about fatigue; (4) in walking on stairs the prisms would introduce new difficulties in judging distance.

I believe that the best solution in this case would be to give this patient ordinary bifocals for constant wear, and a prism containing single-vision near glasses for prolonged near work. She could utilize the ordinary bifocals for every-day use, since she could have adequate near vision through the reading segments for the purposes usually required. It is true, they would not be so effective for prolonged reading but, for such purposes, the single-vision reading glasses could be used.

It is fortunate that this patient profited by prisms, since the data were not adequate to predict that prisms would help. It would have been important to know whether the near exophoria was measured through the reading glass because, if it were not, we could be sure that the patient had more than 12$^{\Delta}$ of exophoria while wearing the near correction. The measuring of a near point of convergence would also have been helpful, and amplitude of fusion measurements were absolutely indicated. Lastly, one might have tried the

therapeutic test of occluding one eye to determine whether that relieved symptoms.

QUESTIONS

House Officer: Would you not expect much poorer uncorrected vision in a person who had such a substantial refractive error?

Dr. Sloane: I would expect poorer vision, but the ability to read letters on a test card varies with many people for the same refractive error. This ability is probably related to a combination of familiarity with letters and the degree of ease with which the person may have been in the habit of getting about without glasses, a habit which promotes the accurate interpretation of blurs. In examining draftees you will note that many boys having 2D. myopia will vary in their uncorrected vision from 10/200 to 20/50.

SOLUTION

For prolonged near use, the following prescription was ordered: O.D., +2.25D. sph. ⊃ −2.25D. cyl. ax. 115°; with a 2.50$^{\Delta}$ base in for near; O.S., +2.25D. sph. ⊃ −2.25D. cyl. ax. 60° with a 2.50$^{\Delta}$ base in for near.

For everyday wear, these glasses were ordered: O.D., +0.50D. sph. ⊃ −2.25D. cyl. ax. 115°; O.S. 0.50D. sph. ⊃ −2.25D. ⊃ cyl. ax. 60° (with the addition +1.75D. sph.).

A FOOT SWITCH TO CONTROL THE ILLUMINATION OF THE REFRACTING CHART*

WALTER H. FINK, M.D.
Minneapolis, Minnesota

A continuous exposure to an illuminated chart during the process of refraction leads to early ocular fatigue and greater difficulty in concentration. In addition, a certain amount of confusion results in changing lenses when the patient constantly watches an illuminated chart.

This apparatus provides an easy control of the illumination of the chart. By

Fig. 1 (Fink). The switch is manipulated by pressure of the foot.

the use of the floor switch, the examiner's hands are free to manipulate the lenses, and yet he can turn the illumination on and off with no loss of time. The illumination can be under perfect control and used only when needed.

It has been found that turning off the chart illumination while changing lenses, or for short rest periods during the refraction, definitely lessens ocular fatigue. A longer, more accurate concentration is possible on the part of the patient.

The foot control can be used with either the projector type of chart or a

* Read at the eighty-first annual meeting of the American Ophthalmological Society, at Hot Springs, Virginia, November, 1945.

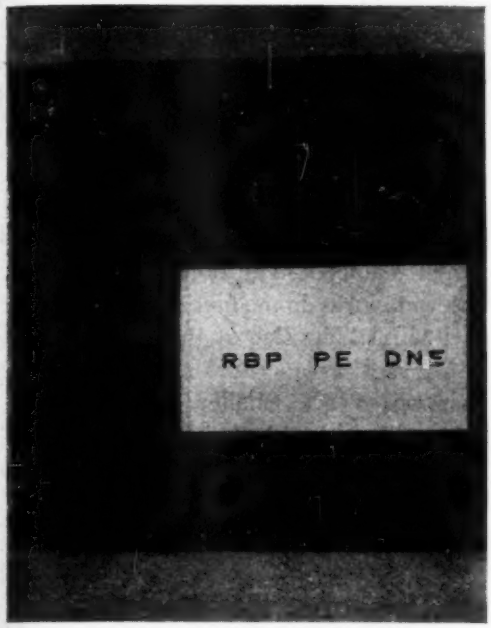

Fig. 2 (Fink). The photograph illustrates the arrangement of the recessed chart.

movable chart recessed in the wall. If the nonprojector type of chart is used, it is necessary to recess the chart in the wall 2 to 3 feet, so that when the light is off the patient cannot read the symbols. This is accomplished by having an opening 1½ feet square in the wall and the chart recessed into the next room. The space between the wall opening and the chart is enclosed and painted a flat gray. The illumination is placed just inside the opening in the wall and out of sight of the patient. A movable chart is used, and only one line of symbols is exposed at a time. The movement of the chart is controlled by the examiner seated near the patient. Daylight can be used in the examining room.

1029 Medical Arts Building (2).

AN INSTRUMENT FOR TESTING BINOCULAR VISION*

WALTER H. FINK, M.D.
Minneapolis, Minnesota

The Howard-Dolman apparatus is not practical for the average oculist's office. Since its use provides valuable information, a more practical method should be found. This instrument is suggested as a substitute for it. Although it does not replace the Howard-Dolman apparatus, and its efficiency cannot be estimated in percentage, it gives the examiner—with

* Read at the eighty-first annual meeting of the American Ophthalmological Society, at Hot Springs, Virginia, November, 1945.

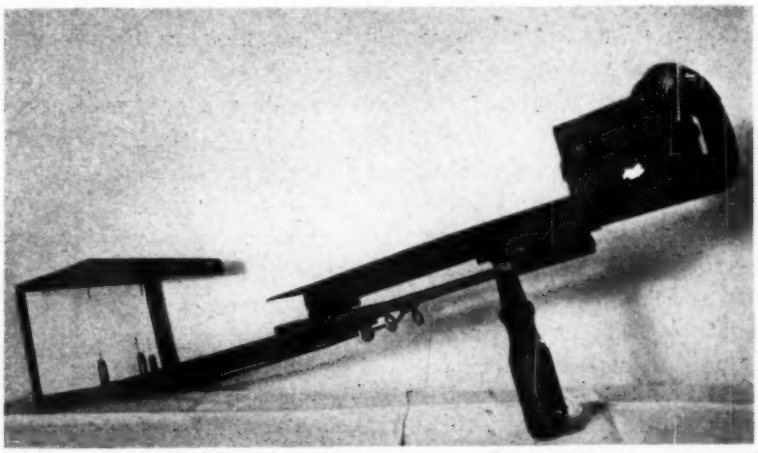

Fig. 1 (Fink). An instrument for testing binocular vision.

little effort—a comparatively accurate impression of the amount of binocular action. The instrument is simple in design and easily comprehended by young children. It is a quick, convenient check to be used to determine whether or not the patient has binocular action. The method has proved of special value as a routine procedure.

Description of the Instrument

The patient views the targets through two openings similar to a stereoscope except that no lens is used. One-half meter away are four movable vertical wires of variable diameters and one inch in length. The position of each target is controlled by a sliding rod. These rods vary in length. The patient adjusts the movable target to the proper position by moving the sliding rod back and forth.

Immediately above these targets are four nonmovable vertical wires which are placed in variable positions and which vary in diameter. The object is to align the lower wires immediately beneath the upper wires. The size of the targets cannot be used as a criterion, because the upper wires are smaller or larger in diameter than the lower wires.

1029 Medical Arts Building (2).

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

December 3, 1945

DR. MAURICE L. WIESELTHIER, *presiding*

SHADOW CASTING DEVISE IN BIOMICROSCOPY

DR. G. KLEEFELD presented a paper on this subject during the instruction hour.

ZONULAR MEMBRANE AND ITS CHAMBERS

DR. H. MINSKY presented a motion picture on this subject.

EMBRYOLOGY OF THE ZONULE

DR. A. KORNZWEIG said the difficulties associated with the study of the development of the zonule are similar to those which are associated with the studies of all hyaline and glass membranes in the eye. These substances do not stain well, especially when they first appear. They are fragile and are immediately changed by the process of fixation and staining. The most recent theory is that the fibers are derived from the neuro-ectodermal tissue in the same way as the vitreous. This theory attempts to place the origin of the vitreous, the zonular fibers, and the internal limiting membrane of the retina under one common factor. The cell, which is responsible, is believed to be the Müller cell. It gives rise to the internal-limiting membrane through the medium of its footplates. The vitreous body, itself, may be a product of the Müller fibers because the internal-limiting membrane and the vitreous are so intimately attached. Since the ciliary body is formed by an extension forward of the margin of the optic cup, the inner layer (the non-pigmented retinal layer), also gives rise to fibrils which, eventually, become the zonular fibers. The cells of the inner layer, which are responsible, are believed to be similiar in type to the Müller cells in the retina.

Three slides were shown. Two were diagrammatic; the third was a microphotograph of the zonular region of a four-month embryo.

TWO CASES OF DEHISCENCES OF THE ZONULAR LAMELLA IN CONTUSIONS

DR. MORRIS DAVIDSON described two cases. The first was the case of a man who was struck in his left eye by a door-check spring, in 1940. Hyphemia subsequently developed. Six months later, a tenuous, bluish membrane was found. It projected from the very small, deformed pupil and was seen floating in the anterior chamber. The iris root transilluminated, lower temporally. Maximal dilatation of the pupil disclosed a temporal lens subluxation and an incomplete choroidal rupture, lower temporally. The membrane was attached to a curved, jagged line running from the 5- to the 7-o'clock positions on the anterior lens capsule. There were no zonular fibers nor tags of them. The serrated lens equator was clearly visible, as well as the ciliary processes. An anteroposterior, subcapsular opacity was noted during the course of subsequent observations. When seen four years later, vision was still 20/200, with little increase in opacification. An interesting feature of the case was the gradual increase of myopia. A minus-two sphere combined with a minus-two cylinder corrected the refractive error when first seen; this increased gradually in six months to

a minus-five sphere with the same cylinder.

The second case was that of a 41-year-old man whose left eye was struck by a large chip, in 1943, with development of hyphemia. Six months later, on maximal dilatation, an almost complete annular detachment of the zonular lamella was found. The ring of the exposed lens capsule retained its shagreen for about a year, when it disappeared with the increasing subcapsular opacification and formation of folds in the sector where the membrane was attached.

In neither case, was there hypertension noted at any time.

Practical considerations in biomicroscopy of the zonula

Dr. Milton L. Berliner said that there has recently been renewed interest in the morphology and dynamics of the zonular system, especially because of the increased popularity of intracapsular cataract extraction. The original concept of the zonular system's membranous structure is being revived, while the belief that it is a collection of fibers permitting free passage of the aqueous fluid of the posterior chamber is no longer universally held. The individual fibers making up the system do not end at the peripheral ridges or in the valleys between the ciliary processes. Most of them reach almost to the ora serrata and are 6 to 6.5 mm. long. The ciliary processes separate the zonule into single bundles.

Biomicroscopy, in cases where the zonule is exposed sufficiently to be accessible, is performed under high magnification, and with intense direct focal illumination in order to make apparent, by the Tyndall phenomenon, otherwise invisible structures. The pupil should be dilated, if possible, and the room darkened. Slight movement of the beam accentuates visibility of the fibers which, even in favorable cases, can be seen only as far as the tips of the ciliary processes. The zonular fibers appear as delicate threads which glisten when viewed by specular reflection. The fibers inserting on the anterior aspect of the lens extend far axially from the equator, while posteriorly they insert closer to the equator. When the fibers are visible, it is rare to find them entirely intact, the bundles being spread apart or missing in certain areas. Frequently, torn fibers can be seen curled up at their attachment to the capsule. In other cases small white dots on the capsule mark their previous sites of attachment. Unbroken fibers attached to luxated or pathologically shrunken lenses attest to their elasticity.

It is possible that ectopia lentis, microphakia, and sphenophakia are due to a hereditary defect in the anlage of the zonule, with the fibers being aplastic or stretched. In those cases in which there is considerable tearing of the anterior zonular fibers, the anterior surface of the lens may be more curved than normal, emphasizing importance of the fibers in accommodation. When the equator of the lens is visible, irregularities can be seen at the margin where the zonular fibers are torn, indicating a retraction of the lens in the absence of zonular traction.

After inflammation—for example: iridocyclitis, if shrinkage of the lens or iris coloboma (congenital, operative, or traumatic) permits inspection—alterations in the zonule are seen. Fibers may be taut, stretched, torn, or absent. The fibers may be sheathed by pigmented or whitish deposits. In old iridocyclitis, heavily pigmented fibers appear like miniature brown cords of rock candy. These changes, indicative of zonular destruction, explain the ease with which complicated cataract can be extracted intracapsularly. They

also explain spontaneous luxation of cataracta complicata.

The frequency of dislocation after trauma shows the readiness with which the normal zonule tears; the negative pressure of the patellar fossa and the hyaloideocapsular ligament being of lesser importance in maintaining the position of the lens. When the lens is displaced, inequalities in the depth of the anterior chamber will be noted, and the edges may become undulated. Iridodonesis and phacodonesis may be present. Traumatic iritis and hemorrhage may result in deposits on the fibers. Vogt has described a case in which, after a perforating injury, there was the unusual picture of separation at the equator, by fluid of the capsule from the underlying lens substance. This was the result of increased zonular traction.

Traumatic detachment of the zonular lamella was first seen and described by Meesmann, in 1925. He noted in the area of lens displacement a "free-floating, crinkled membrane" concentric to, but separated from, the lens margin. Undoubtedly, more frequent biomicroscopic examinations of heriditary, spontaneous, or traumatic displacement of the lens will reveal such separation of the zonular membrane. Its traumatic detachment at the equatorial region in this manner proves that its nature is individual and unlike the flaky, axial separation caused by age or heat-cataract.

Discussion. Dr. Henry Minsky pointed out the possible relationship of the true concept of the zonular structure to the theory of accommodation, to the mechanism of spontaneous retinal detachment, and to some operative procedures for the relief of hydrophthalmos.

It is possible to combine the Helmholtz theory of accommodation with the views held by Tscherning, if we consider that the anterior and posterior zonular leaves become relaxed, while the hyalo-zonular leaf remains taut during the active part of accommodation.

It seems, from the intimate insertion of the zonular fibers into the retina and the hyaloid, that the longer it takes to rupture the zonular fibers, the more certain is it that an extracapsular operation should have been performed. If the zonular fibers are ruptured quickly and easily, the intracapsular operation is the one of choice.

None of the four theories outlined by Duke-Elder, in considering the mechanism of detachment of the retina, succeeds in explaining the production of a spontaneous detachment resulting from sudden generalized muscular strain such as occurs in stumbling, sneezing, wrestling, or stunt flying. If we assume in these cases that, with the protective bracing of the whole body, there takes place a spasm of the ciliary muscle, we can understand how a previously diseased spot in the retina could be transformed into a hole, since the retina and hyaloid are suddenly pulled forward by means of the insertion of the zonular fibrilla in these two structures. The crescentric holes, seen clinically, all have their concave edges face forward. In the experimental production of such holes in the retina, Dr. Minsky has found that the concavity always faces the direction of pull. Since the ciliary muscle is the only part of the eye that can exert such a pull, it seems reasonable to assume that it plays a significant role. It might, therefore, be desirable to immobilize the ciliary body in the meridian of the tear by surface diathermia, as well as to seal off the hole.

In hydrophthalmos, the zonular chamber is enormously dilated. In one case, the sclera was trephined 5 mm. back of the apparent limbus, and the zonular chamber was opened without the loss of vitreous through a perforation of the ciliary body.

The tension was reduced to normal, and the diameter of the cornea was decreased from 16 to 12 mm. The scleral operations recently described by Terry and by Lehrfeld are probably related to the easy exit of aqueous from the zonular chamber.

The structure of the zonule of Zinn can be appreciated only when the observations of the gross anatomy are in complete reciprocal agreement with the interpretations of the microscopic picture. When the uveal coat is removed from the underlying structures in the fresh eye, it is found that the zonular fibers are attached more intimately to the vitreous and to the retina than to the ciliary body from which they arise. After the complete removal of the retina, a serrated white line is seen in the hyaloid at the site of the ora serrata—the hyalo-retinal ligament. If the lens-vitreous body is suspended by sutures placed in the zonular fibers, a hammocklike cradle of the zonular fibers, in which the lens rests and from which the vitreous hangs, is produced. This demonstration proves that the zonular fibers are unquestionably inserted into the hyaloid by means of the hyalo-retinal ligament.

This ligament can be recognized in microscopic slides as the plaque filling the angle between pars plana and the ora serrata. It is made up of zonular fibrilla which go to form the zonular fibers coursing on the face of the vitreous—the hyalo-zonular leaf (the "innermost" fibers of Salzmann, the "fibrae orbiculposteriocapsulares" of Garnier). The hyalo-zonular leaf forms the posterior boundary of a real aqueous space—the zonular chamber ("orbicular space" of Garnier)—and terminates in the ligamentum hyloidea capsulare on the posterior surface of the lens. The anterior limit of this zonular chamber is bounded by the posterior and anterior zonular leaves. It may contain products of inflammation and is enormously enlarged in cases of hydrophthalmos.

Dr. Berliner pointed out that Dr. Minsky indicated that there may be zonular fibers originating from the ciliary processes. He thinks most of the fibers come from the pars plana. Since some of the fibers branch as they come into the area of the ciliary processes, they may, at times, seem to run from ciliary process to ciliary process. However, they do not form actual communications between ciliary processes themselves. This can be verified in preparations made after the technique of Eggers, in which the fibers can be lifted by a glass rod. Dr. Minsky also suggested that zonular pull at the ora during accommodation may be a factor in retinal separation. According to this theory, hyperopes should be more susceptible to retinal separation than myopes.

Leon H. Ehrlich,
Secretary.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

December 11, 1945

Dr. W. D. Stinson, *presiding*

Idiopathic retinal detachment in pregnancy

Dr. J. Wesley McKinney reported the case of Mrs. C. P. McK., who was seen the first time for this illness, June 24, 1944. She gave the history that one week before she had bumped her head and broken the left lens of her glasses. The blow was received on the left forehead. Immediately afterward a black spot appeared before the left eye. The night before examination, the vision became much impaired. She was seen Saturday afternoon at the hospital, and a large bullous

detachment was found involving almost the entire temporal retina. No tear was made out at this time. The patient did not care to remain in the hospital and, consequently, was sent home to lie on the left side with both eyes padded. Two days later when she reported to the office, the retina was found to be completely reattached and looked in no way abnormal. No tear could be made out. Vision was 6/9, mostly. After lying in bed for two weeks with both eyes padded, she was given pinhole glasses which she wore for two months. Vision improved to 6/7.5, and observations at intervals revealed no change in the condition of the retina. On October 30th, however, the temporal periphery of the retina again became detached. The patient had been in bed with pads on both eyes for 10 days before she came in for this examination. There was, at this time, a minute, slitlike tear 4½ disc diameters from the ora on the horizontal meridian. The detachment did not reach to the macula, and the retina was not elevated very high. The patient refused operation and remained in bed until the retina again became flat. She wore pinhole glasses for another two months. Gradually, it became very difficult to see the tear, and the retina maintained a perfectly normal appearance. Soon after the last episode of detachment, the patient became pregnant. The retina, however, remained apparently normal until May 2, 1945, when she was about seven months pregnant. At this time, the retina again became detached in the temporal area. A large bean-shaped tear could be seen. The diathermy operation was performed May 5, 1945. On May 10, five days postoperative, she went into labor and was delivered of a premature infant which did not live. The retina remained attached and, at the present time, the vision is 20/20, mostly, and the field is full.

Cataract extraction with secondary glaucoma

Dr. E. C. Ellett reported the case of Mr. W., aged 42 years, who was operated in December, 1944, for cataracts in both eyes. The opacity was mostly posterior capsular, the near vision being J19. The fundi could be seen, and the veins were tortuous, but not full. Tension was normal. A simple extracapsular operation was done in each eye, three days apart. Spontaneous anterior-chamber hemorrhages occurred in the right eye on the sixth day, and in the left eye on the seventh day. The patient left the hospital two weeks after the first eye was operated upon and used atropine in each eye once a day. He returned in two weeks with tension of 41 and 52 mm. Hg (Schiøtz). Vision was 6/6 and 6/24. Under miotics, the vision became normal. The tension remained high for a while but came down in a week to 25 mm. (O.U.). In May, the tension was still down, but there was a thin secondary membrane in each eye and some reduction of vision in the right eye for near (J4). A Wheeler capsulotomy was done on each eye in October, 1945. There has been no trouble with O.S. except that a miotic is necessary to keep down the tension which once went to 32 mm. Immediately following the capsulotomy, the right eye became very soft; tension was 7 mm. Under atropine, it rose in about three weeks to 40 mm., and miotics do not reduce it. On November 24th, vision was: O.U. 6/6 and J1; tension was 40 and 25 mm., the eye grounds were normal, and the fields were not disturbed.

Metastatic carcinoma of the choroid

Dr. Ellett reported the case of Mrs. W., aged 44 years, who was seen in April, 1945, with the history of a blur in the right eye for two weeks and a diagnosis

of retinal detachment. Vision was 6/60, improved to 6/9. The whole field was blurred, and there was a central reactive scotoma. She had had the right breast removed in 1938, followed by X-ray treatments and no further trouble. The left eye was normal. Pupils were equal and active. The right eye showed a hyperopic blonde fundus. In the region of the ascending temporal vessels, 1 disc diameter from the disc, a white elevated area was visible under and along the vessels. It extended down toward the macula. This area was fairly well-defined. It was seen with a +5 lens. It was yellowish white with no pigment. Transillumination was negative. Tension was 20 mm. Hg (Schiøtz). She was given X-ray treatment to the eye. During the summer of 1945, she died from multiple metastases in her chest.

Choroidal detachment

Dr. Ellett reported the case of Mrs. C., aged 58 years, who had a combined intracapsular extraction, O.D., on June 26, 1945, and the same operation O.S. on July 2. The left eye healed without incident and vision was 6/6 and J1. On July 9th, the 13th postoperative day, the chamber in the right eye was seen to be very shallow, and a three-lobed detachment of the choroid was seen, the lobes being in, down, and out. Vision was 6/7.5. On October 22nd, the detachment was still present, and there was a small cystoid area at the center of the wound. This was treated once with trichloracetic acid. On November 5th, when the patient was next seen, the detachment had disappeared, and vision was normal with glasses.

A case report of buphthalmos

Dr. P. M. Lewis and Dr. G. M. Wallace presented the case of M. A., a colored girl four years of age, who was seen in consultation with the pedriatric department of the John Gaston Hospital on December 8, 1945.

The patient's ophthalmic history began at the age of one, at which time her parents first noticed that the left eye appeared larger than the right eye. Since that time the left eye had progressively increased in size; to their knowledge the eyes had never been red or inflamed.

Ocular examination revealed relative vision in the right eye to be identity of objects. There was questionable vision in the left eye. By general inspection, one gained the impression that the left eye was proptosed, larger than normal and exotropic. The dimensions of the right cornea was 12.5 mm., horizontally, and 12 mm., vertically. Corresponding measurements of the left eye were 15 mm. and 14 mm. The depth of the anterior chamber of the right eye appeared normal; however, the depth was markedly increased in the left eye. The cornea of the right eye was transparent, but that of the left eye appeared hazy. It was 2 mm. above the center. Opacity, measuring 1.5 mm. by 1 mm., was present. Tension is either eye was not increased by digital examination. Fundoscopic examination of the right eye did not reveal any abnormality. Similar examination of the left eye revealed the disc to be cupped markedly and a marked thinning of the retina. These conditions were seen best with a minus-25 lens in the ophthalmoscope.

Diagnoses made by the pediatric department were: hydrocephalus, upper-respiratory infection, umbilical hernia, dwarfism, mental retardation, and rickets.

Bilateral simple glaucoma

Dr. M. B. Seligstein presented a colored man, aged 59 years, who had noticed a skim over his left eye and failing vision in both eyes. He was hit over the right eye with a piece of stove wood

many years ago, and had not seen out of this eye since that time.

Examination showed a large cupping of both optic nerves. Perimetric fields were: L.E., small amount of concentric vision, up to 5 and 10 degrees; R.E., could not be taken. Tension with the tonometer was 32.5 mm. Hg (Schiøtz). Vision was: R.E., light perception; L.E., 20/400. The tension was reduced by myotics in the left eye, only.

On September 8th, an Elliot's trephining operation was performed on the left eye, and an iridencleisis on the right eye. On October 6th, the tension was 18 mm. in the right eye, and 22 mm. in the left eye. The patient was last seen on November 15th, when tension had dropped to 8 mm. in both eyes. A spoke-wheel cataract had formed in the right eye. With a −1.25D. cyl. ax. 90°, vision in the left eye was improved to 20/200. There was a slight enlargement of the field of vision, eccentric, from 10 to 38 degrees on the lower-temporal field and 38 to 35 degrees on the upper-temporal field.

Serpiginous ulcer of cornea

Dr. Philip Meriwether Lewis presented a white man, aged 56 years, who was still under treatment in the hospital for a severe ulcerative keratitis.

This man was a mechanic who, on December 1, 1945, got a piece of iron rust in his left eye. The rust was removed, apparently cleanly, the following day by a general practitioner. The next day pain in the eye became severe. When first seen, exactly three days after the injury, a purulent ulcer was present. A deep crescent-shaped area of keratitis surrounded the centrally placed ulcer.

The ulcer was scraped out and cauterized, foreign protein, sulfadiazine, and penicillin were given, and the latter used locally. Seven hours later the eye was so much worse that the anterior chamber was opened. Because of the ulcer's location and extreme severity, a Saemisch section was done. Thereafter, the wound was reopened daily. Penicillin, locally, and 20,000 units, intramuscularly, were given every three hours. Typhoid H antigen, intravenously, and sulfadiazine, orally, were also administered. Considerable improvement had occurred so that when presented, seven days after treatment was started, the cornea was clearing, and there was no hypopyon.

Clinically, this ulcer appeared to be a pneumococcic infection, but cultures failed to reveal the organism. A few Staphylococci albus and an unidentified Gram-negative bacillus were the only organisms grown in two attempts. The extreme rapidity and severity of the infection following the penetration of the cornea by a metallic foreign body were the unusual features of this case.

Sympathetic ophthalmitis

Dr. Harold Kushi (by invitation) presented a case report of sympathetic ophthalmitis following cauterization of an iris prolapse with the Ziegler cautery.

E. G., a white man, aged 51 years, was admitted to the hospital on October 8, 1945, at which time a simple intracapsular cataract extraction with peripheral iridotomy was performed in his left eye, followed in five days by a similiar extraction in his right eye. No vitreous was lost at either extraction. During the removal of the corneo-scleral sutures from his left eye on the eighth postoperative day, partial iris prolapse developed. The following day a corneo-scleral suture was placed over the prolapse, and the prolapse was cauterized with the Ziegler cautery. Healing was uneventful, and the patient was discharged on the 15th postoperative

day. The media appeared clear, and the fundi looked normal at the time of discharge. Atropine was prescribed for home use.

About a month after leaving the hospital, the patient began having pain in his left eye. He was seen soon after and admitted to the hospital for treatment and observation. On entry, both eyes were markedly injected. Tension was normal; cornea and aqueous were clear; irides thickened; and pupils mid-dilated. Posterior synechiae were present in the left eye, and vitreous opacities in both eyes. Early vascularization of the left iris could be seen. No keratitic precipitates were seen with the slitlamp. Vision was perception of hand movement.

To date, the patient has had a total of 500,000 units of penicillin, 18 gm. of sulfadiazine, 4 injections of Typhoid H antigen totaling 250 million units, sodium salicylates, and, locally, atropine neosynephrine in a 10-percent emulsion. Improvement has not been marked. Pain is less than on entry to the hospital, and the patient states that his vision is better than on entry. Objectively, the findings have remained the same. A few keratitic precipitates are now visible in both eyes. The question arises as to whether this case is one of sympathetic ophthalmia resulting from the cauterization of the iris prolapse. Any suggestion as to further course of treatment and prognosis would be appreciated.

CHICAGO OPHTHALMOLOGICAL SOCIETY

December 17, 1945

PETER C. KRONFELD, *president*

(Held at the Illinois Eye and Ear Infirmary, Chicago)

CLINICAL MEETING

COLOBOMA AND ECTOPIA LENTIS IN ARACHNODACTYLY

DR. THEODORE C. ZEMAN presented a white woman, aged 20 years, who has spent all of her school days in sight-saving classes. She presented herself at the Illinois Eye and Ear Infirmary with a retinal detachment in her left eye which had occurred shortly after the extraction of an ectopic lens four months previously.

In addition to the symptoms of arachnodactyly, the patient showed, in her right (unoperated) eye, an ectopia lentis in the upward and lateral direction. Upon dilation of the pupil to a diameter of 5 mm., the lower-nasal equator of the lens came into view. Instead of being circular, its visible portion had the shape of an octagon which, according to the literature, is a rare congenital deformity interpretable as multiple colobomas. The zonule was visible around the entire nasal border. The posterior segment of this eye was also unusual in that it showed a partial optic atrophy without apparent cause.

NONSURGICAL CURE OF A RETINAL DETACHMENT WITH TEARS

DR. THEODORE C. ZEMAN presented a white woman, 30 years of age, who came to the Illinois Eye and Ear Infirmary in March, 1945, with the complaint of an orange-colored film over her left eye of a few days' duration. At that time the cor-

rected vision of her right eye was: 20/30 with a −3.00D. sph. ⌒ −1.00D. cyl. ax. 175°; L.E., 20/200 with a −3.25D. sph. ⌒ −1.00D. cyl. ax. 170°. The left had always been the weaker eye. Examination of this eye revealed the presence of a retinal detachment with a high degree of elevation, occupying the sector from the 10:30- to the 4-o'clock positions. Two small tears were present in the 1- and 2-o'clock positions respectively, 10 disc diameters from the posterior pole. No signs of an active or inactive uveitic process could be seen at that time. Under rest in bed and by use of pinhole spectacles, complete reattachment occurred within 11 days and has persisted up to date. The patient wore pinhole spectacles and refrained from strenuous body movements for another month. At first, no reason for this reattachment in the presence of frank tears could be recognized. Now it is apparent that each tear, though still open, is surrounded by fine chorioretinitic changes. The corrected vision in this eye is now 20/50.

Bilateral pulsating exophthalmos following head injury

Dr. Benjamin E. Lyons presented a 59-year-old white woman who had been struck by a taxi two months before, after which she was unconscious for 24 hours. During her two-week period of hospitalization, she was found to have a right-parietal linear skull fracture. Since the fragments were in good approximation, the patient was treated only symptomatically. The complaints during her stay in the hospital were severe headache, diplopia, and a constant, loud, to-and-fro swishing and roaring head noise. Two weeks later, after going home, she noted that her left eye was starting to swell and protrude. This was followed in two weeks by a similar process in the right eye.

She was admitted to the Illinois Eye and Ear Infirmary with bilateral exophthalmos, that in the right eye greater than in the left, associated with a large, red, indurated swelling of the conjunctiva of the right lower fornix. The left eye revealed only a small amount of conjunctival chemosis. There was a slight pulsation of both globes coincident with the pulse beat, which was accompanied by a to-and-fro, high-pitched, blowing bruit heard best in both temporal and right mastoid regions. There was a right papilledema of four diopters, a right total ophthalmoplegia, and a left partial external ophthalmoplegia.

This patient was presented as a case of pulsating exophthalmos, probably caused by a traumatic arterio-venous fistula of the right internal carotid artery in the cavernous sinus.

Bilateral optic atrophy due to meningioma

Dr. Benjamin E. Lyons presented a 37-year-old housewife who accidentally noted complete loss of the right vision 14 years ago, 8 months after an episode of mumps and right Bell's palsy. She consulted an eye physician who told her only that nothing could be done in the absence of light perception.

In May, 1945, she first came to the Illinois Eye and Ear Infirmary, complaining of blurred vision in the opposite eye. Examination revealed right facial nerve weakness, bilateral primary optic atrophy, right exotropia. Vision was: R.E., no light perception; L.E., 20/30+2, with a generally constricted visual field (5° above, 25° temporally and below, 10° nasally). X-ray studies showed: increased sclerosis of the anterior clinoid processes and thickening of the floor of the skull; also, moderate sclerosis and thickening of the inner frontal table. This was attributed to a developmental

anomaly and thought not to be clinically significant.

The patient was then referred to the Department of Neurosurgery at the University of Illinois where further X-ray studies were made and interpreted as showing destruction of the right sphenoid wing in addition to hyperostosis of the tuberculum sellae. Exploration of the skull was carried out in September, 1945, and an extensive meningioma of the right optic-nerve sheath was removed.

This case illustrates the importance of repeated X-ray studies of the skull in cases of unexplained atrophy of the optic nerve.

Congenital toxoplasmosis

Dr. Henry N. Ricci presented a 13-year-old girl with a history of an acute febrile condition and convulsions at 21 months for which she was hospitalized. At this time, fundus lesions were noted and, 1½ years later, extensive bilateral chorioretinitis was found.

The convulsions were nonepileptic in nature, there being no aura, no loss of consciousness, no frothing, nor tongue biting. The attacks lasted from 10 to 20 minutes, with the patient suffering a severe headache afterward. In 1937, skull X-ray studies revealed intracerebral calcification. In 1943, a ventriculography was done which revealed dilated ventricles. During the past three years, the attacks have been occurring at greater intervals and with less severity. The last attack occurred in July, 1945. Repeated Wassermann, Kahn, and tuberculin tests with P.P.D. have been negative.

The ophthalmic examination at present reveals a corrected visual acuity of 20/30 in the right eye and 20/200 in the left. A quiescent, deep chorioretinitic lesion, 2 disc diameters in size, lies just nasal to the right disc. A similar lesion involves the macular area of the left eye. In the vitreous, there are membranous residues of exudates.

The patient presents the classical clinical manifestations of toxoplasmosis; namely, intracerebral calcification, central nervous system disturbance as evidenced by convulsions, internal hydrocephalus, and bilateral chorioretinitis.

Rubeosis iridis

Dr. H. Isabelle McGarry presented a 70-year-old white man who was admitted to the Illinois Eye and Ear Infirmary on November 7, 1942. He gave a history of diabetes mellitus and was taking 10 units of protamine-zinc insulin each morning. His fasting blood sugar was 190 mg./100 c.c. He gave a history of poor vision in the left eye for nine months and severe pain in the left eye for three months. Corrected vision was: R.E., 20/20; L.E., 5/200, not improved. The right disc was normal; there was a scatter of superficial and deep hemorrhages throughout the fundus and of old white exudates in the perimacular region. Gonioscopy revealed the right angle to be wide open without any newly formed vessels. The left eye showed ciliary injection, many fine, pigmented corneal precipitates, and neovascularization on the iris from the pupillary border down to the angle which was completely closed. There was a far advanced glaucomatous excavation. The tonometric readings at that time were normal in the right eye and around 55 mm. in the left.

Because of uncontrollable tension and severe pain, a cyclodiathermy was performed on the left eye on December 1, 1942. The operation was successful in that the eye became and has remained comfortable. The pressure, however, has remained elevated, and all vision has been lost. In the left eye, the typical picture of rubeosis iridis has developed gradually, with no elevation in tension, as yet.

Angiomatosis retinae

Dr. A. A. Baraff presented a 13-year-old white girl, recently reported here with vision of 20/20, corrected, in the right eye, and no light perception in the left eye. The right fundus showed innumerable discrete, whitish deposits in the outer retinal layers. The temporal periphery was occupied by a large, whitish mass which was studded with multiple, red, mulberry-like nodules. The vessels leading to this area were dilated and tortuous. The visual field showed a nasal constriction corresponding to the temporal lesion.

The left eye, blind for a number of years and in a state of atrophy, was enucleated several days ago. The posterior segment of this eye was not visible.

The case was presented as an angiomatosis with retinal degeneration. As yet cerebrospinal and pancreatic findings are normal, and Dr. Bailey, of the University of Illinois Neuropsychiatric Institute, is of the opinion that the condition is confined to the eyes.

Electrocoagulation to the right temporal periphery will become advisable, if unmistakable signs of progression occur.

Characteristic types of filtering scars after corneo-sclerectomy or iris-inclusion operations

Dr. J. D. Walsh presented cases to show the difference between transconjunctival and subconjunctival filtration, the former occurring in blebs designated as type 1 and the latter occurring in blebs designated as type 2.

The microscopic substratum of the bleb of type 1 is a polycystic derivative of the conjunctiva, characterized by a thin external wall, thin septa between the cysts, and obliteration of the preëxisting blood vessels. Such blebs function by permitting intraocular fluid to pass from the corneo-scleral fistula into the conjunctival sac, as can be demonstrated by means of the Seidel test. The sum total of the areas with thin external walls determines, ceteris paribus, the efficacy of the bleb. Such blebs are apt to form in areas where Tenon's capsule is absent and where the conjunctiva is thin. They are, therefore, the more common form of bleb after trephining operations, but may occur at the site of the conjunctival incision, or, in very old people, at sites of senile atrophy of the conjunctiva and Tenon's capsule. Corneal blebs are merely lateral extensions of conjunctival blebs.

Blebs of type 2 are less easily recognized. The conjunctival surface is not transformed. Only the deeper layers show succulence and obliteration of the preexisting vessels. By gentle massage of the globe, the areas of type-2 blebs can be made to rise in characteristic fashion. The Seidel test is invariably negative, even after massage of the globe.

After most successful corneo-sclerectomy or iris-inclusion operations, combinations of bleb type 1 and type 2 are present. There appears to be no regular or demonstrable relationship between certain techniques of flap dissection and the type of bleb finally present.

Scientific program

1. The eye examination in the differential diagnosis of the disoriented patient. Benjamin Milder, Capt. (MC), A.U.S. (Published in this Journal, August, 1946.)

2. The scleral-resection (eyeball-shortening) operation. Dr. Derrick Vail. (Published in this Journal, July, 1946.)

3. Synkinetic and asynkinetic overaction of the inferior oblique muscle: Diagnosis and Treatment. Dr. George P. Guibor.

Robert Von der Heydt.

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THE CHANGING SCOPE OF MEDICAL SPECIALTIES

The scope of medical specialties is constantly expanding and contracting. A brief review of the changes during the past 20 years, as compared with several other specialties, shows that ophthalmology has fared well.

In general, the layman is more interested in, and better informed about, medical problems than formerly. Magazines and large newspapers have on their staffs writers who specialize in medical topics. The radio tells the public how to recognize cancer in the early stages; the moving pictures depict a story in which the leading character has a brain tumor; the theatre bares psychoanalysis; the advertisements tell how serious a simple head cold may be; and campaign posters tell how we can lower the incidence of venereal disease. Therefore, for the same reason that a

second-year medical student tends to become fearful lest he may have the disease to which he is introduced, the layman is more apprehensive now about his health and more frequently seeks medical advice for mere reassurance.

General surgery has been the cradle for the surgical specialties, nurturing them until they have been able to stand on their own feet as independent fields of surgical pursuit. Such has been the case with gynecology, urology, orthopedics, plastic surgery, neurosurgery, and more recently, thoracic and cancer surgery. Such will probably be the case with vascular surgery in view of the recent rapid development of new techniques in that field, such as coarctation of the aorta, portacavel anastomosis, ligation of the ductus arteriosus, and so forth.

In general medicine, the wear-and-tear diseases have increased so that the state of one's coronary arteries or the height of one's systolic blood pressure are common talk. Cardiology and allergy have emerged as specialties. The incidence of some infectious diseases has been greatly reduced and some have been practically eliminated.

Advice by the newspaper columnists, preventive medicine campaigns, school courses in hygiene including the mental phase, have all, no doubt, affected the practice of pediatrics. Complicated feeding formulas for infants have given way to more or less routine procedures so that infant feeding is no longer a major aspect of pediatrics. The use of vaccines and sera has eliminated many of the childhood diseases. Pediatrics is now more frequently concerned with the care of the premature infant and with the child's proper mental and emotional development, the aim being to prevent mental quirks, social maladjustment, or more serious nervous disturbances.

Otolaryngologists deal mostly with infection; therefore the advent of chemotherapy has narrowed their services considerably. Also, this specialty has suffered from a whispering campaign among the laymen against the treatment of sinusitis by instrumentation. The only major addition to the therapeutic repertoire of otolaryngologists is the fenestration operation.

Chemotherapy has taken the urologist out of the urethra and decreased the complications from gonorrhea. This specialty has for some unknown reason lost syphilis to the dermatologists, but its practitioners have made notable strides in the surgery of the prostate and kidney.

In neurology, less syphilis of the central nervous system is seen because the campaigns against the disease have effected better and earlier treatment. The neurosurgeons are becoming their own diagnosticians with the result that fewer neurosurgical patients pass through the hands of the neurologist. The neurologists are concerning themselves increasingly with functional and psychosomatic disorders, diseases emanating from dysfunction of the endocrines, and from allergy. Their therapeutic armamentarium has always been sparse but the electric shock treatment is quite promising.

In ophthalmology during the past two decades, we have extended our frontiers and lost little ground. The most notable addition to our surgery is the operation for detachment of the retina. The corneal transplant operation is no longer in the experimental field but is now included in the regular surgical repertoire. A dacryocystectomy is passé and has been replaced by the dacryocystorhinostomy. After some contention between the rhinologist and the ophthalmologist, this operation has now been incorporated in the domain of ophthalmology. A similar tug-of-war

has been waged over plastic work in the region of the eye with the result that ophthalmology has retained a fair portion of it. The subjects of aniseikonia and orthoptics have been developed and applied. The recognition of keratoconjunctivitis sicca as a part of the Sjøgren syndrome, the appreciation of the roles toxoplasmosis, sarcoid, and brucellosis play in ophthalmology are all steps forward, and there are many other noteworthy advances which could be mentioned.

The changes in medicine occur so gradually and over such a long period that an assessment is necessary to appreciate them. Even this cursory glance at the changes during the past 20 years shows that there is a constant shifting in the scope of the specialties and that not one is static. Algernon B. Reese.

MISGIVINGS AS TO THE TECHNIQUE OF CATARACT OPERATIONS

There is ample room for doubt as to choice of technique in performance of the operation for cataract. It is entirely reasonable to assume that various types of cataract call for different methods of approach. On the other hand, very few are the operators who throughout their professional career continue to employ exactly the methods taught to them during their early training.

That this is not merely a sign of progress from an inferior method to a better one is fairly well demonstrated by the fact that at any given period any selected group of eminent ophthalmic surgeons will be found to vary in their choice of technique. It is also significant that the statistical results recorded by the members of such a group, and the complications experienced, will differ much less widely than their choice of methods.

No ophthalmic surgeon, however eminent and experienced, is immune from failure in the results obtained by cataract operation. This is one reason why the individual operator is usually found ready to try a number of different methods in the course of his career.

Here and there a well-known eye surgeon may be found disposed to doubt whether real advance in cataract surgery has been achieved in the past half or three quarters of a century. One of these skeptics is Manuel Rivas Cherif, formerly of Madrid, Spain, but now domiciled in Mexico ("Voluntary complications in the operation for cataract." Archivos Médicos Mexicanos, 1946, volume 4, February, page 3). The author means precisely what he says in speaking of "voluntary" complications, for he is convinced that many of the so-called improvements in cataract technique invite trouble instead of avoiding it.

In his 34-page paper Rivas Cherif finds fault, one after the other, with many of our boasted developments in technique. From simple, he says, the cataract operation has become complicated, often to the detriment rather than to the benefit of the patient. He decries fashion in ocular surgery or a desire to adopt the new for fear of being thought antiquated, urging that too often the so-called new is merely a return to an earlier method. Unless, he says, we are sure that the patient gains, it is undesirable to occupy half an hour over an operation that ought to last five minutes at most.

As an example of the author's judgment may be mentioned his contention that in the great majority of cases it is adequate to use contact anesthesia with instillations of 4-percent cocaine solution, which he has found effective even where iridectomy

was necessary. Objections to retrobulbar anesthesia include inability of the patient to coöperate in rotation of the eye and the possibility of causing serious orbital hemorrhage or of puncturing the optic nerve. Hypotony induced by retrobulbar anesthesia, though welcomed by some surgeons, is blamed by Rivas Cherif as a serious inconvenience in the performance of extracapsular extraction. It is also, he believes, to be held responsible for the frequent occurrence of detachment of the choroid, which he regards as far more inimical to the future of the eye than is usually admitted. Akinesia he regards as not indispensable, and as unnecessarily distressing for the average patient, without possessing adequately compensating advantages. Only in very rare cases would he use canthotomy.

Rivas Cherif points out that although we all agree on the importance of a correct incision for success of the operation, unfortunately our unanimity is solely one of principle, because after having performed large, small, and medium incisions, in every conceivable part of the cornea and of the anterior sclerotic, we are still discussing this technical detail.

In the early part of the present century, a number of European surgeons experimented with the use of either one or two lance keratomes for the limbal incision. In 1928, Aubaret employed two keratomes, one in each hand, entering the eye with both at the same time; and when the two blades met he withdrew one keratome and divided the remaining corneal bridge.

Rivas Cherif still prefers the limbal incision of two fifths of the corneal circumference, and omits the conjunctival flap because of a belief that it adds to the danger of hemorrhage. He points out that an incision situated on the limbus is farther from the root of the iris than from the border of the fully dilated pupil, and he argues that with such an incision iris prolapse is rendered less possible and iridectomy less necessary. He clings to the use of the Graefe knife for the section, as quicker and more accurate than keratome and scissors. He is, however, an adherent of the sclerocorneal suture, which he regards as having substantial advantage with practically no inconvenience.

It is natural that Rivas Cherif should express himself as to the choice between the intracapsular and the extracapsular method. He is manifestly more or less partial to the extracapsular. He states his agreement with the opinion of Van Lint that mature or almost mature cataract should be extracted without the capsule, that the unripe cataract should be extracted intracapsularly in patients whose physiologic age is between 60 and 70 years, that patients less than 60 years of age should be dealt with by the extracapsular method because the more resistant zonule renders the intracapsular dangerous, and that the extracapsular should be used after 70 because the lens masses surrounding the nucleus are not sufficient to produce secondary cataract.

Yet most of us have seen a good many exceptions to all of these rules. In spite of the downright assertion of the late T. Harrison Butler, a year or so ago, that the intracapsular was far more dangerous than any other type because of the heavy pressure he had found necessary to deliver the lens (British Journal of Ophthalmology, 1943, volume 27, November, page 495), it is probable that most operators of experience now undertake the intracapsular method in the majority of their cases, and regard it as generally to be preferred to the extracapsular.

Rivas Cherif's assertion that, from the day after the extraction, those operated upon by the extracapsular show much less ocular redness than those operated

upon by the intracapsular method certainly does not agree with the experience of most United States surgeons who widely practice the latter. Can it be that some Mexican surgeons (like Harrison Butler in his brief experience) are accustomed to use more pressure in intracapsular extraction than is usual among North American operators, instead of relying largely upon slow, gentle traction with the capsule forceps?

Another opinion by Rivas Cherif which seems to come down to us from the past is that "always when there is no indication to the contrary the cataract should be allowed to reach complete maturity." How many of our cataract patients lack such an "indication to the contrary"? Surely the vast majority of them, long before the worse eye reaches full maturity, are subjected to serious inconvenience as to the use of the better eye. A most important benefit conferred by the popularity of the intracapsular operation is avoidance of the long twilight period involved in waiting for complete maturity.

Earlier details of technique are forgotten, to be later revived, retried, sometimes reapproved, but seldom in the original combinations. It is well for us all, and especially for the novice, to realize that the methods now in use may not be the only ones acceptable or successful, but are just as likely to undergo further change as those which, widely used many years ago, have been swept into relative oblivion.

W. H. Crisp.

RADIOACTIVE ISOTOPES

One fact proved to us by wartime research programs as, for instance, that of the National Research Defense Committee and the Office of Scientific Research and Development, was that certain victories in investigative work can be achieved in a vastly accelerated manner by coöperation between research scientists. Duplication of effort is reduced to a minimum, and strength and encouragement lends impetus to the whole performance when there is coördination of activity of men carrying out research on any matter of common interest. An example of the carry-over of this spirit of coordination of knowledge and essential materials for a finer type of research is the program of the Radioactive Isotope Committee of the Massachusetts General Hospital of which the Massachusetts Eye and Ear Infirmary is a part. Other research groups will do well to follow the plan of this committee, seeking consultation from the best qualified members of their respective scientific communities. Physicists from Harvard and the Massachusetts Institute of Technology serve as consultants for the radioactive isotope project at the Harvard Medical School, radioactive materials being obtained largely from the Massachusetts Institute of Technology cyclotron.

A talk given by Dr. Francis D. Moore at the Massachusetts General Hospital and abstracted in *The News* for August, offers a concise discourse on "The Application of Isotopes to Surgical Research." This abstract read, in part, as follows:

"The word 'isotope' means 'same place' or 'same phase' and denotes an element occupying the same position chemically as another element but differing from it in weight. Most of the common elements of the earth's surface are mixtures of various isotopes and, of late, the application to many problems of isotope production and detection has expanded rapidly and in many fields, ranging from determinations in submicroscopic life up to 'atomic' explosions in the air over Japan.

"The basic pattern for biologic research with radioactive isotopes was laid many

years ago when Continental workers studied some problems relative to the biology of lead, using radium as a 'tracer.' The possibilities of such methods remained limited and application to a wide variety of biologic problems was impossible until the last decade when, with the development of the cyclotron, a host of radioactive isotopes of common, biologically important elements became available. A tremendous upsurge in this type of research has since taken place, and for a few years it was almost a monthly, and even in some cases a daily, occurrence for physicists to discover a new isotope! As each element in the periodic table was bombarded with deuterons in the cyclotron, a study of the reaction products yielded many hitherto unknown isotopes of previously known elements.

"Many of these substances were radioactive and by their radioactive emissions announced their presence in the tissues, body fluids, and in the test tube.

"In its peculiar organ specificity, iodine is almost unique among the body's elements. Furthermore, the radioactive isotopes of iodine emit gamma radiation which penetrates the tissues of the patient and can be detected externally with a Geiger counter. This fortunate combination of circumstances plus a convenient half-life gave to the iodine work a peculiar clarity and interest which attracted wide attention and is quoted in most of the articles one may read on the biologic application of isotopes. This work has recently blossomed into the treatment of thyrotoxicosis with radioactive iodine and in the application of these methods to the diagnosis and treatment of thyroid tumors as well as the further elucidation of thyroid physiology.

"In 1941, under the aegis of Dr. Aub and his group, work was commenced on radioactive colloids, making some of the common colloidal di-azo dyes radioactive by synthesis into the molecule of two atoms of radiobromine. This work was of interest because these dyes concentrate in abscesses and tumors and because one might hope by such means to diagnose abscesses from outside the patient by use of a Geiger counter or to treat tumors by injecting the radioactive dye. This work was done under considerable difficulty because of the very small amounts of radioactive substances which were available at that time. Now, with the great expansion in radioactivity research engendered by the atomic bomb and the development of the 'chain-reacting pile' as a means of producing radioactivity, these problems are being reopened and reinvestigated by workers in many places, and it is with considerable gratification that we now find workers in Philadelphia and in Berkeley, California, reinvestigating these problems with the higher amounts of radioactivity obtained from the atomic bomb plants.

"In 1942 the interests of the Surgical Service shifted to the study of water balance in burns, a problem encouraged by the government OSRD contracts, and pursued throughout the war. Up to the present time, research has been carried out on the Surgical Service employing radioactive isotopes of sodium, chlorine, bromine, potassium, iodine, phosphorus, iron, and hydrogen. The end-point detection involved in these research problems (with the exception of iron) have been carried out by our own investigators in the surgical laboratories; the radioactive materials have been obtained largely from the Massachusetts Institute of Technology cyclotron.

"The development of the atomic bomb has attracted wide public attention to the problems of nuclear physics and has made 'neutron' a household word. The develop-

ments relative to the bomb have also given rise to much interest in the research world, and we read daily in the papers of thousands of dollars being poured into work with radioactive isotopes, especially as applied to the problems of malignancy. There are many rewards to be found in this field, and many new discoveries will be made. Some will doubtless apply to the field of malignancy, but many others will be useful and important in everyday problems of the physician and surgeon.

"The types of research problems which can be investigated with isotopes can be divided into several categories:

1. "Membrane equilibrium and permeability. This is the basic contribution of radioactive isotopes to research. Reaction rates, permeability rates, equilibrium ratios and cell permeability can be studied with radioactive isotopes in a fashion that is impossible by other means. In this way we have studied capillary permeability, red-cell permeability, the changes in permeability of skin cells to sodium after burns, and from methods falling into this category, we may look to the future to find many answers to questions concerning water balance, electrolyte administration and pre- and postoperative care. The central problem in this therapeutic field at the present moment might be described in a few words as 'potassium deficit.' Is there a need for potassium in parenteral fluid therapy? If so, how great is the need and how does one know when the need has been satisfied? These and related problems can best be solved by the judicious use of isotopes." (Among the contributions in this category of particular interest to ophthalmologists is the work of Cogan, Kinsey, and Grant (1942) on the use of heavy water, deuterium oxide (D_2O) as a tracer for ordinary water in measuring the movement of water into and out of the aqueous, as well as other contributions they have made using radioactive isotopes.)

2. "'Tracing' elements or molecules in the body. By the use of radioactive substances the distribution and reactions of various organic and inorganic compounds can be traced in the body. The classic work of Schoenheimer and Rittenberg, in which heavy stable isotopes rather than radioactive substances were used, is an example of studies in this field which have clinical significance. From their work, we find that all the protein in the body is in a constant state of flux and equilibrium, and that there is no such thing as storage or inert protein. By similar methods, we may in the future discover the site of the formation or action of various hormones, the distribution of nutritional essentials in the body, the fate of drugs and cancer-forming compounds.

3. "The location of certain elements or molecular configurations from outside patients. The use of iodine in this connection has already been mentioned. After iodine is given to the patient, a Geiger counter can be placed over the thyroid and the amount taken up by the thyroid can be roughly estimated. Work on the detection of abscesses has also been mentioned. Future work in this field holds much of interest relative to circulatory physiology, circulatory velocity, the effect of certain types of sympathetic surgery on circulation in various areas in the body, and other studies. In using this technique, one must always bear in mind the fallacies and pitfalls of externally placed counter measurements as they are affected by various thicknesses of tissue and other biologic factors.

4. "The measurement of body 'areas.' By use of isotopes one can measure with some degree of accuracy the exact amount of certain areas of body fluid in the body and the amounts of certain elements

present. This type of work is at present the main concern of the Department of Surgery as it relates to isotope investigation. We can measure the extra-cellular space with sodium and the total body water with deuterium. We can measure the total body potassium with radioactive potassium, and we can measure the degree of potassium utilization by the development of a potassium tolerance test that depends upon the urinary excretion of a measured dose of radiopotassium. In this way a chemical 'dissection' of the human body can be carried out on the living patient. Previously, a complicated quantitative analysis of a human cadaver would be the only way of getting the same data.

5. *"Treatment.* The treatment of various sorts of radio-sensitive diseases with radioactive isotopes is an obvious application of these materials. Thyrotoxicosis has been mentioned, as has thyroid tumor. Radiophosphorus has been developed as a means of treating certain types of blood dyscrasia and polycythemia vera. The future of this field lies not so much in the further application of inorganic ions to the treatment of tumors as it does in the discovery of specific organic chemical configurations which are taken up in tumor tissue and which can be rendered radioactive so as to administer selective internal radiation to tumors.

"One cannot discuss this field without stressing the hazards of radiation, and a committee has recently been formed in this hospital to review isotope research being carried out here with the hope of avoiding such hazards. The purpose of this committee is not only to correlate work and avoid unnecessary duplication or expenditure, but also to safeguard the patients and the workers from radiation which may be dangerous. Five years ago when one or two millicuries of a radioactive isotope was regarded as mammoth production, dangers to the worker were not as great as they are now when the cyclotron can make 170 to 200 millicuries of radiosodium in a few hours. Such large amounts of activity can be dangerous to both worker and patient; realization of these hazards must be brought home to all those involved, and proper precautions taken.

"Future trends in this field will be watched with interest by physicians and surgeons alike. It is essentially a collaborative type of investigation and has always involved coöperation at least between the physician and the physicist. Now we must extend this coöperation to the various services in our hospital so that the knowledge and skill of the Medical Service, Pediatric Service, Surgical Service, and others can be brought to bear upon problems that concern us all—problems to be solved by the tools of the physicist."

I believe this abstract, as quoted above, merits our serious attention, for only by a coördinated approach, strengthened by the availability of experts in the fundamental branches of science—an approach such as is exemplified in the recommendations of the Radioactive Isotope Committee of the Harvard Medical School—can the majority of significant eye problems be solved.

S. Rodman Irvine.

OBITUARY

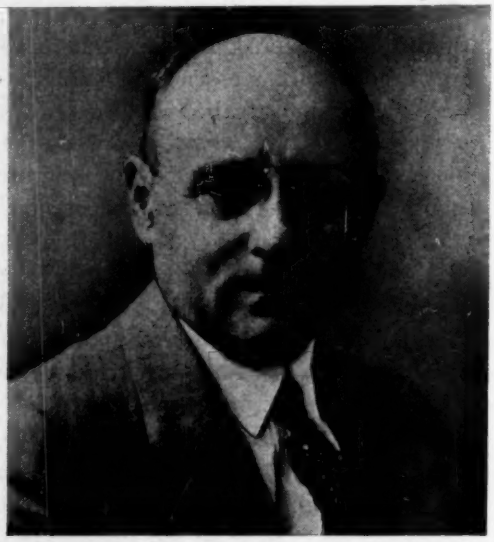
ROBERT VON DER HEYDT

(1875-1946)

The death of Dr. Robert Von der Heydt on September 18, 1946, was a great loss to the profession of ophthalmology and the loss of a valued and beloved member.

Dr. Von der Heydt had come to be

well-known and appreciated by a large number of men in the United States, principally because of his leadership in developing the use of the slitlamp. His earliest interest was in the mechanical side of ophthalmology, for he was a true craftsman and able to improve upon almost any optical instrument that came



ROBERT VON DER HEYDT

into his hands. Soon, however, the clinical interest dominated, and he studied biomicroscopy with Vogt in Zurich and with Fuchs and others and translated Vogt's first Atlas into English. He taught groups in post-graduate courses, gave courses almost yearly at the Academy and at the Illinois Eye and Ear Infirmary, and trained numerous individuals in this branch. Many of us went to him for advice and help, for his generosity in the sharing of knowledge and his expenditure of time for others were unlimited. He was always coöperative and kind as a consultant. Many valued his help and friendship.

Those attending the meetings came to know him for his color slides of external and fundus diseases, for he adapted kodachrome to both when most men were still using black and white. He was also among the pioneers in contact-lens fittings.

Dr. Von der Heydt was born in Wiesbaden, Germany, in 1875, and came to this country at the age of six. He received his education in the Chicago schools and was sent to Germany at the age of 16. In his early manhood, he studied watch making and always carried a watch he himself had made. Working with his father on his return from Germany, it became his duty to keep the large clock at Rush Medical College in good order. It was here that he began to wish for a medical education and for a teaching position at Rush. This wish was fulfilled through his own efforts. He received his medical degree at the University of Illinois in 1903 and practiced ophthalmology in Chicago until his death.

Dr. Von der Heydt was Professor of Ophthalmology at the Chicago College of Medicine and Surgery from 1909 to 1917, Associate Professor at Rush Medical College from 1926 to 1940, and at the University of Illinois from 1940 to 1943. From 1943 until his death, he was Professor Emeritus of Ophthalmology at the University. He was ophthalmologist at the Illinois Charitable Eye and Ear Infirmary from 1905 to 1943 and was attending ophthalmologist at Michael Reese Hospital and West Suburban Hospital.

Dr. Von der Heydt was a member of the American Ophthalmological Society to which he was elected in 1930. He was a member of the American Medical Association and of the Academy of Ophthalmology and Otolaryngology, and was past president of the Chicago Ophthalmological Society.

Dr. Von der Heydt is survived by his wife, Edith Richardson Von der Heydt, and two daughters, Mrs. Franklin Briston and Harriett Von der Heydt.

E. B. Fowler.

BOOK REVIEWS

DISEASES OF THE RETINA. By Herman Elwyn, M.D. Clothbound, 587 pages, 170 illustrations, 19 in color. Philadelphia, The Blakiston Company, 1946. Price, $10.00.

Dr. Herman Elwyn, senior assistant surgeon of the New York Eye and Ear Infirmary, divides his book, "Diseases of the Retina," into eight parts. Each part is a classification or category of the subject matter he presents, and these categories are:

Part 1, Diseases of retina resulting from disturbances in circulation; Part 2, Diseases of retina resulting from vascular malformation; Part 3, Degenerative diseases of retina on a hereditary basis; Part 4, Inflammatory diseases of retina; Part 5, Tumors of retina; Part 6, Diseases of retina leading to retinal detachment; Part 7, Developmental anomalies of retina; Part 8, Radiation injuries of retina.

The division of the subject matter of this book under these arbitrary headings was disappointing to this reviewer. It has resulted in a somewhat scattered classification and does not present the material "for students, practitioners, and ophthalmologists," as the author states was his intention, but presents it only for ophthalmologists.

In view of present-day discussions concerning the classification of fundus disease (and it would seem this should be a must in a treatise as complete as this book), one would expect the most recent classifications to be mentioned. This reviewer is aware, however, that classifications as such are merely a means to an end and not the means to further research in a subject which is so important in an age of preventative medicine.

Dr. Elwyn does bring several "new" diseases of the fundus to the attention of the reader, diseases which, I believe, are not to be found in other texts; such as, fundus findings in endocarditis and the blood dyscrasias.

The discussion of the pathogenesis and pathology of each disease presented in this book is both well-written and well-documented, and Dr. Elwyn has been careful to bring his terminology up-to-date. The bibliographies at the end of each chapter are, however, not at all complete.

All in all, "Diseases of the Retina" is a readable book, well-written, well-illustrated, and set in exceptionally legible type that is easy on the eyes. It should find a place in every ophthalmic library.

Nathan K. Lazar.

EYE HEALTH—A TEACHING HANDBOOK FOR NURSES. Prepared and published by the National Society for the Prevention of Blindness, Inc., 1790 Broadway, New York 19, New York. Paper bound, 108 pages, 5 figures, bibliography, index. Price, $0.60.

This is a well-arranged and useful manual, prepared particularly for the school, public health, or industrial nurse. It is surprisingly broad of scope, although of necessity compact, and gives to its reader more than an introduction to the eye and its use or abuse. Its chapters deal in part with the organs of vision, the seeing process, making the best use of the eyes, "screening" eye examinations, the eyes in childhood, eye health problems in adult life, eye safety, first aid and follow-up for eye injuries, and the teaching of eye health.

It is well and clearly written in terse sentences and should be easily understood. It is recommended not only to those for whom it is designed, but also to lay people interested in eyes and eye health, of whom there are many.

Derrick Vail.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

1
GENERAL METHODS OF DIAGNOSIS

Almeida, A. de. **Examination of the ocular fundus in children, as bearing upon diagnosis.** Arquivos do Instituto Penido Burnier, 1945, v. 7, Dec., pp. 76-85.

The author discusses the relationship of ophthalmology to pediatrics, and reports a personal case of hemorrhage of the newborn, with observations of a year of investigation in the Maternity Hospital of Campinas. The author's review touches briefly on cerebral hemorrhage and hematoma, tumors and meningitis, phacomatoses, acute illnesses, and avitaminoses. (4 figures.)

W. H. Crisp.

Casanovas, J. **Radiographic methods for the localization of foreign bodies of the visual apparatus.** Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, May, pp. 327-337.

After reviewing several methods of localizing ocular foreign bodies the author presents the following method. A silver ring of 0.5 mm. thick and 11 mm. in diameter is sutured to the limbus at three points equidistant from each other. A binocular bandage is put on and frontal and lateral X-ray pictures are taken making allowance for the upward and outward rotation of the closed eye. Preliminary fluoroscopy aids in the orientation. If the radiograph has been taken properly the ring will appear perfectly round in the frontal view and as a straight line in the lateral view. A diagram is drawn consisting of two concentric circles, one of 11-mm. diameter corresponding to the limbus and the other 24 mm. in diameter corresponding to the diameter of the globe. Another diagram is drawn that consists of a 25-mm. circle, the circumference of which cuts the extremities of the 11-mm. vertical line that corresponds to the lateral view of the ring. By combining the two lines an accurate localization of the foreign body is obtained. For bone-free radiography the method of Vogt is used with the modification that a broad spatula is used to carry the dental film.

J. Wesley McKinney.

Freitas, Orlando de. **Bacterioscopic examinations of conjunctival secretions.** Arquivos do Instituto Penido

Burnier, 1945, v. 7, Dec., pp. 179-195. (See section 5, conjunctiva.)

Goldmann, H. **A self-registering bowl perimeter with projection of the target.** Ophthalmologica, 1945, v. 109, Feb.-Mar., pp. 71-79.

The author, in cooperation with the firm of Haag-Streit in Berne, Switzerland, constructed a bowl perimeter which fulfills all the conditions necessary for exact quantitative perimetry. Objects of various size and color and always exactly of the same reproducible degree of contrast are projected by a movable optical system onto the field of the perimeter bowl. The optical system is attached to the bowl. The movements of the projected target point are controlled by a manipulator behind the perimeter bowl. These movements can be executed in any direction, not only radially as in the usual arc perimeter. Exact fixation by the patient's eye and its control by the examiner is safeguarded by special means.

Max Hirschfelder.

Guerry, III, Du Pont. **Recent advances in the diagnosis and treatment of diseases of the external eye.** Virginia M. Monthly, 1946, v. 73, April, pp. 173-178.

This excellent paper discusses the diagnosis and treatment of external eye diseases such as blepharo-conjunctivitis, chalazion, trichiasis, molluscum nodula, herpes zoster ophthalmicus, metastatic dacryoadenitis, gonorrhea, vernal catarrh, trachoma, Parinaud's syndrome, corneal ulcers, and dendritic ulcers. I. E. Gaynon.

2

THERAPEUTICS AND OPERATIONS

Bien, Morris. **General anesthesia in ophthalmic surgery.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1119-1121.

Brown, C. A. **Penicillin in ophthalmology.** Brit. Jour. Ophth., 1946, v. 30, March, pp. 146-167.

In this comprehensive article the author discusses the bacteriologic properties of penicillin as regards experimental data on the penetration of the drug in the normal and infected eye, and the control of infection. Clinical evidence of its action in 125 cases of infection leads him to conclude that penicillin is the ideal drug for combatting bacterial infections of the eye. It is harmless to ocular tissues and lethal to most bacteria that attack the eye. It acts equally well when applied topically for external infection and when injected into aqueous or vitreous for intraocular infection. (36 references.)

Morris Kaplan.

Fraser, I. C. and Scott, A. A. B. **Penicillin treatment of ocular inflammation.** Brit. Jour. Ophth., 1946, v. 30, March, pp. 168-176.

The details of 38 cases of blepharitis and conjunctivitis in the treatment of which penicillin was used topically are presented in tabular form. The solution used contained 500 units per c.c. and was instilled every four hours. In eight cases lamellae of penicillin containing 180 or 100 units were used four-hourly. No other treatment was employed and the results were most striking. Blepharitis, that had existed for 20 years was cured completely in a few days. Two patients with Eales' disease were not benefited by penicillin.

Morris Kaplan.

Goldman, H. **The basis of exact perimetry.** Ophthalmologica, 1945, v. 109, Feb.-March, pp. 57-70.

The author investigated with mathematical exactness the different variables which are of importance in exact perimetry and reached the following conclusions. To perform exact relative perimetry with colourless objects adaptation equilibrium must be established, the contrast between object and perimetry background must remain constant, and the basic illumination must not change greatly. Under such conditions quantitative relations may be found between perimeter objects of varying size. A quantitative comparison of the sensitivity of individual retinal points becomes possible on the basis of perimetric data gained with objects of different size. One can characterize each point on the retina not only through its differential sensitivity, but also through its cumulative power ("Summationsleistung") for objects of different size. The cumulative power of normal retinal points may be considered constant over wide areas of the visual field. The limits of the constancy were determined in the study and it was found that distinct vision seems to decrease this cumulative power, while dark adaptation seems to increase it. Perimetry with white objects depends on the sharpness of vision with which these objects are seen. Errors of refraction, presbyopia, and cloudy media reduce the black-white visual field considerably. Patients with refractive errors should wear their glasses during perimetry. When the media are cloudy, the results of perimetry with white targets can only be used with caution in the diagnosis of disturbances in the retina or optic nerve. Colour perimetry seems to be less influenced by such blurred images.

Max Hirschfelder.

Lech Junior. **Vanadium in ocular syphilis.** Arquivos do Instituto Penido Burnier, 1945, v. 7, Dec., pp. 204-211.

The author's statistics suggest a striking advantage from the use of potassium and sodium tartrovanadate. As compared with other specific drugs, the mean time of recovery fell from four to two months, the average improvement in sight in four months was from 0.17 to 0.38. After six months of vanadium treatment, 63 percent of the patients showed vision improved to 0.5 or better. (3 graphs.) W. H. Crisp.

Mann, Ida. **Intraocular use of penicillin.** Brit. Jour. Ophth., 1946, v. 30, March, pp. 134-146.

Experiments were done on rabbits to determine the effects of intraocular injection of penicillin in various concentrations and to determine the concentrations remaining at known intervals of time after injection. Immediately after the injection of 200 to 1500 units into the aqueous of 16 eyes a coagulum of many fine particles that completely filled the anterior chamber was observed with the slit lamp. This disappeared after several hours. A slight corneal reaction disappeared in several days. The severity of reaction did not vary with the concentration of the drug.

Injection into the vitreous produced a local opacity immediately, which eventually involved the entire vitreous. On the fifth to seventh day a severe exudative chorioretinitis appeared and progressed rapidly to complete atrophy and blindness. In four to five weeks a degeneration of the iris was noted and was accompanied by cataract in some eyes. Microscopically most of the tissues were unrecognizable. The retina, choroid, and optic nerve became fibrous.

Into six eyes chemically pure penicillin was injected with entirely different results. After a mild local reaction the fundus became entirely normal in three weeks in all eyes. The reactions in the other group were doubtlessly due to impurities in the drug.

In the second group of experiments it was found that no penicillin remained in the aqueous and vitreous one hour after the intravenous injection of 5,000 units. After injection directly into these areas the drug persisted in beneficial amounts for six hours. It was found to diffuse from the vitreous into the aqueous.

Case reports of 29 eyes treated with injections are presented. The solutions used contained from 1,000 to 50,000 units in 0.25 c.c. of fluid which is the ideal volume for injection. Results were considerably better than could be expected from any other form of treatment. Morris Kaplan.

Missiroli, Giuseppe. **The frequency of various types of pneumococcus in ocular affections and their respective sensitivity to sulfamids.** Boll. d'Ocul., 1944, v. 23, July-Sept., pp. 166-194.

The author made a systematic study of the distribution of the various types of pneumococcus according to modern immunologic classification. He examined 145 strains of the coccus isolated from eyes with conjunctivitis, dacryocystitis, and serpiginous corneal ulcer. Twenty-three types predominated. In a second series the author studied the sensitivity of pneumococci from sulfamico-pyridinic preparations. The types of organism differed in resistance to sulfamids. (Bibliography.) Melchiore Lombardo.

Parry, T. G. W. and Laszlo, G. C. **Thrombin technic in ophthalmic surgery.** Brit. Jour. Ophth., 1946, v. 30, March, pp. 176-178.

The authors present a preliminary report on the use of commercial thrombin (P-D) thrombin topical) as a healing agent in eye surgery. In cataract extraction they placed this thrombin paste under a large conjunctival flap and used no sutures. In squint surgery they placed the paste on Tenon's capsule or under the conjunctiva after suturing the muscles. Results were most promising. The thrombin also acted as an efficient hemostatic. Morris Kaplan.

Scuderi, G. **The action of sympamina (beta-phenyl-isopropylamine).** Rassegna Ital. d'Ottal., 1946, v. 15, March-Apr., pp. 94-106.

Sympamina is a snythetic drug, structurally quite similar to ephedrine. The chemistry is explained and the literature reviewed. Dropped into the eye, sympamina produces moderate mydriasis, which begins in ten minutes, has no effect upon the ocular tension, produces a contralateral miosis, and has a synergistic action with cocaine, atropine, and homatropine. The action is somewhat unpredictable and varies in different eyes. The rate of absorption through the cornea was found to vary considerably. The action of this drug varies with the pH. The preparation seems to be very similar in its effect to the other drugs of the adrenin group. Eugene M. Blake.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Amsler, M. and Klauser, O. **Measurement of high values of refraction in keratoconus.** Ophthalmologica, 1945, v. 110, July-Aug., pp. 29-33.

The extreme values of refraction

found in conical corneas are not suitable for measurement by the ordinary Javal ophthalmometer. With the aid of the photokeratoscope of Amsler the reflex image of a disc of Placido was photographed on a series of steel balls of known curvatures. The pictures obtained can be compared with the ones obtained from the reflex image of conical corneas. In this way corneal curvature can be estimated fairly exactly. The authors offered a complete scale of steel-ball-reflex images for this purpose.

Max Hirschfelder.

Angius, T. **Experimental research on twilight vision.** (Part 2.) Rassegna Ital. d'Ottal., 1946, v. 15, May-June, pp. 182-190.

Since vitamin A is essential to the formation of rhodopsin, Angius felt that there might be an increase of this substance in the periphery of the retina. The Birch-Hirschfeld adaptometer was used in the experiments. The conclusions reached were: (1) that vitamin A has no clear action in the perception of form in the peripheral field in normal subjects who are not fatigued; (2) that it has a favorable effect upon subjects exposed to intense light and fatigue; (3) that it brings about an increase in the perception of light at the periphery of the retina, and (4) that it has no appreciable action on normal individuals exposed to dazzling, if not fatigued.

Eugene M. Blake.

Bender, M. **Polyopia and monocular diplopia of cerebral origin.** Arch. Neurol. and Psychiat., v. 54, Nov.-Dec., p. 323.

Cases of objective and subjective disturbances in the visual fields with associated defects in mechanisms of fixation are described. The patients had either monocular diplopia or polyopia or both, and some of them also had symptoms of spatial disorientation. It is concluded that the rapid and involuntary movements of the eyes produced by faulty fixation tend to stimulate, simultaneously, the original macula and any new maculas which may have been formed as a result of impairment of vision.

Theodore M. Shapira.

Bender, M. B. and Teuber, H. **Phenomena of fluctuation, extinction, and completion in visual perception.** Arch. Neurol. and Psychiat., 1946, v. 55, June, pp. 627-658.

In three illustrative cases of disturbances of visual fields with scotoma of varying extent and density, phenomena of fluctuation, extinction, and completion were observed.

The three phenomena appear to be related to each other. Fluctuation was characteristic in all cases, particularly on prolonged exposure. Extinction seemed to represent a more extreme form of fluctuation; since it occurred readily in areas which were otherwise characterized by fluctuation. In these areas extinction could be demonstrated frequently on double simultaneous stimulation. With rapid tachistoscopic exposure of patterns, the defects in the visual fields seemed to be reduced in their extent in all three cases. This fact suggested that these field defects (though produced by circumscribed lesions) were a result of processes of extinction rather than signs of a permanent loss in function. For that reason, rapid tachistoscopic exposure would prevent extinction and produce the appearance of completion. Completion could thus be understood as a simple absence of "extinction."

It should be considered that comple-

tion, and other phenomena described in this communication, are not confined to visual and cutaneous perception. Taken in a wider sense, they can be found to pervade the so called higher functions, such as processes of memory and thought. Studies in reminiscence are a case in point. The principles of function which are signalized in the phenomena of fluctuation, extinction, and completion may thus have general application. Theodore M. Shapira.

Biiss, A. F. **The chemistry of daylight vision.** Jour. Gen. Physiol., 1946, v. 29, May 20, pp. 277-297.

Rhodopsin, a red substance obtained from the rods and known as visual purple, is the basis of scotopic vision. It has physical and chemical properties that suggest that it is a conjugated protein which liberates a prosthetic group related to vitamin A as a consequence of the absorption of light. In the living eye, dark adaptation results in the removal of vitamin A and the regeneration of visual purple. In this study of the chemistry of cone vision, Wald's discovery of iodopsin, a photosensitive cone pigment in the retina of the chicken was verified. Iodopsin resembles rhodopsin in its chemical properties but is considerably more labile. (6 figures, 5 tables, references.)

Bennett W. Muir.

Bliss, A. F. **Photolytic lipids from visual pigments.** Jour. of Gen. Physiol., 1946, v. 29, May 20, pp. 299-304.

A method is described for the preservation of iodopsin, the labile photopigment of daylight vision, by freeze drying in vacuo. The lipids released by the action of light on rhodopsin and iodopsin are found to be similar and to possess a labile absorption spectrum in chloroform, with a rising peak at about 390 mμ and a declining peak in the region of 470 mμ. After the change is complete the absorption spectrum closely resembles that of retinene. (2 figures, references.)

Bennett W. Muir.

Carlevaro, G. **An anomaly of refraction.** Rassegna Ital. d'Ottal., 1946, v. 15, May-June, pp. 202-206.

The condition discussed by the author has been variously called asymmetry or decentration, bi-astigmatism, keratoconus frusto, and irregular astigmatism of the lens. Carlevaro modified the keratoscope of Gullstrand for the study of such cases of structural irregularity and he reviews the various theories offered by different observers. He concludes that the correct denomination is asymmetry and decentration.

Eugene M. Blake.

Crisp, W. H. **A device for group demonstration of astigmatism tests.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1094-1098. (1 figure, discussion.)

Hecht, S., Hendley, C., Frank, S., Haig, C. **Anoxia and brightness discrimination.** Jour. Gen. Physiol., 1946, v. 29, May 20, pp. 335-351.

Seven men and one woman, all 17 to 25 years of age, were placed under experimental physiologic conditions corresponding to variations in altitude between sea level and 17,000 feet. Using controlled brightness, the brightness discrimination was tested repeatedly with a Landolt broken ring test object. It was noted that deterioration of contrast discrimination is definite at 8,000 feet and is marked at 15,000 feet. A given increase in altitude results in a greater impairment in contrast recogni-

tion at high altitudes than at lower ones. Although the deterioration in brightness discrimination occurs at all three light intensities tested, the effect decreased as the illumination increased. Cone and rod thresholds are affected equally by low oxygen concentration. It is probable that the retina itself, rather than the central nervous system, may be the seat of the anoxic changes. (6 figures, 4 tables, references.)

Bennett W. Muir.

Hunt, G. D. **Correcting amblyopic eyes.** The Optician, 1946, v. 111, July 12, pp. 476-477.

Too many amblyopic eyes have been fitted with plano or balance lenses. In presbyopic patients the corrected amblyopic eye often makes an effective contribution to the work of the dominant eye. I. E. Gaynon.

McKay-Fergeson, Olrig. **The development of the theory of light.** The Optician, 1946, v. 111, July 5, pp. 453-454.

Descartes first definitely stated that light takes the form of minute fragments of matter traveling from object to image at high velocity. Newton discovered the composite nature of white light. Huygens' wave theory explained the phenomena of reflection and refraction. Fresnel remedied the flaw in Huygens' theory by providing a satisfactory account of the propagation of light in straight lines and explained interference and diffraction. Maxwell then brought out the electromagnetic theory, which was followed by the electron theory of Lorentz. The quantum theory as explained by Einstein, according to which the absorption and emission of energy is a discontinuous process, takes us back to the corpuscular theory. I. E. Gaynon.

McKay-Fergeson, Olrig. **Entopic phenomena.** The Optician, 1946, v. 111, July 19, pp. 495-499.

Entopic phenomena include all visual phenomena that arise from stimuli within the eye. Retinal blood vessels lie in front of the rod and cone layer. If light falls on the retina in such a way as to cast a shadow, the outlines of the blood vessels are observed. The spot phenomenon can probably be ascribed to the leucocytes, inasmuch as the red blood cells overlap one another and cast a continuous shadow except in capillary loops so small that cells can pass singly. Retinal arcs are usually blue and seem to extend from the light source to the projected image of the blind spot. Halos may be produced by corneal epithelium, lens epithelium, or by lens fibers, acting as a diffraction grating. I. E. Gaynon.

Matteucci, P. **Color perimetry.** Rassegna Ital. d'Ottal., 1946, v. 15, March-Apr., pp. 107-124.

The relative value of perimetry with white and colored test objects is thoroughly reviewed. The author concludes that color perimetry is more sensitive than white and that for every defect of the field found with the former there is a defect for white. It is difficult to determine accurately the peripheral limits of the field for color and there appears to be considerable difference in normal subjects, probably because of uncertainty between the chromatic sense and the sense of luminosity. Also the size of the target and the refractive error introduce further problems, as well as the question of attention and the intelligence of the subject.

Eugene M. Blake.

Moron Salas, José. **Procedure for supplying color perception to the color**

blind. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, May, pp. 363-367.

The author points out that there is no corrective treatment for color blindness. It is possible, however, by training, to enable the color blind individual to distinguish to some extent colors in ordinary or known surroundings. It has also been found that the red-green color-blind person is able to distinguish colors by the use of a red glass over one eye and a green glass over the other eye. While the latter may not be practical for general wear, the use of red-green glasses can be useful in situations wherein detailed color perception is needed. The use of these glasses is a valuable aid in the process of education of the red-green color-blind individual.

J. Wesley McKinney.

Reider, N. **Phenomena of sensory suppression.** Arch. Neurol. and Psychiat., 1946, v. 55, June, pp. 583-590.

Clinical studies on suppression phenomenon are reported in which stimuli originating in a normal, or relatively normal, sensory field tended to inhibit or abolish the perception of stimuli arising from an "affected" field.

When this phenomenon involves vision, in the presence of normal visual acuity and normal perimetric fields, it may be mistaken for a post-traumatic neurotic reaction. The mechanisms underlying the patho-physiologic changes are discussed. Emphasis is placed on the fact that the phenomenon may be elicited not only by contralateral but by homolateral stimuli. Theoretic implications of the phenomenon are mentioned.

Theodore M. Shapira.

Roveda, J. M. **Jackson's cross cylinders.** Arch. de Oft. de Buenos Aires, 1943, v. 18, Oct., p. 519.

After reviewing the history and giving the description and technique of the cross cylinder, the author concludes that this procedure is the best method for the exact determination of astigmatism. The test for power and axis are very simple. The fact that the description of the use of the cross cylinder appears more complicated than it is in reality, is perhaps one of the reasons why it has not come into more general use. The principal reasons for its efficiency are (1) its minimal influence on the accommodation, (2) the presentation to the eye under study of a simultaneous increase and decrease of the elements of the tentative correction, and (3) its rapidity. A proper setting of the cross cylinder is essential for its successful use. (Illustrations, and bibliography.)

Plinio Montalván.

Sachs, E. **Abnormal delay of visual perception.** Arch. Neurol. and Psychiat., 1946, v. 56, Aug., pp. 198-206.

The Pulfrich effect, a remarkable stereoscopic and sensitive phenomenon, occurs when a smoked glass or polaroid glass is placed before one eye of a person who is observing a swinging pendulum. Suddenly the pendulum appears to describe a horizontal circle, to approach the observer and recede behind the initial vertical plane. The same effect may occur if with identical illumination the transmission of impulses between retina and visual cortex is delayed. A quantitative test was done on 74 male patients. Of these, five patients demonstrated an abnormal effect, two had the effect in one eye, and 35 matched the normal Pulfrich threshold.

I. E. Gaynon.

Soto Eciolaza, J., and Olivella Casals, A. **Contact glasses.** Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, May, pp. 352-362.

The indications and contraindications for the use of the Zeiss contact glasses together with the procedures for fitting them are discussed.

J. Wesley McKinney.

Thomson, L. C. **Foveal color sensitivity.** Nature, 1946, v. 157, June 15, p. 805.

Thomson and Wright have shown that there is an increase of sensitivity to blue light as the image of the matching field is moved from the center towards the edge of the central fovea, and the explanation of the colour difference here described may be that the fixation point was such that the two halves of the field lay upon areas of the retina of slightly different spectral sensitivity. The irregular shape of the curve may be due to the fact that the image of the matching field has a retinal position which depends upon the wave length. Some difference in the anatomical position of the fixation point for red, green, and blue light has been reported by Hartridge, and it may be that the position of the fixation point is a continuous function of the wave length when small matching fields are used. Theodore M. Shapira.

de Vries, H. **Mechanism of color discrimination and a new type of color blindness.** Nature, 1946, v. 157, June 15, pp. 804-805.

In a previous letter, it was suggested that difference in the luminosity curves are caused by varying numbers of receptors. In order to find new evidence for this, it seemed worth while to study the intensity discrimination and the visual acuity of the three sets of receptors, as these functions depend upon the number of elements.

The author concludes that a flicker photometer may be a valuable instrument in the detection of color blindness (but combined with the anomaloscope), especially because the color blind can adjust the minimum of flicker very accurately. Settings which suggest unusual sensitiveness or insensitiveness to red, point to a color discrimination.

Theodore M. Shapira.

Weiman, Maximiliano. **Considerations regarding contact lenses.** Anales de la Soc. Méx. de Oft., etc., 1945, v. 20, July-Sept., pp. 107-114.

At the end of this short article the author remarks that premature commercial propaganda, by means of moving pictures and ignorant traveling agents, has given rise to deep disappointment in many purchasers of contact lenses. W. H. Crisp.

Woelfflin, E. **Is it possible to influence the congenital disturbances of the color sense?** Ophthalmologica, 1945, v. 109, June, pp. 324-326.

Investigations by Studnitz showed certain oily globules in the retina of baby chicks. These globules were found in the outer parts of the cones and contained three pigments of the carotinoid group. Whether it is possible to influence color blindness by the use of these carotinoids can be determined by experiment only when they become available, in sufficient quantities to be fed to subjects over a long period of time.

Max Hirschfelder.

4

OCULAR MOVEMENTS

Berens, C., and Romaine, H. H. **A comparative study of sutures employed in surgery of the extraocular muscles.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1126-1134. (3 tables, 4 figures, references.)

Hartman, E. **Diagnosis and treatment of heterophorias.** Ann. d'Ocul., 1946, v. 179, Feb., pp. 71-82.

After a prolonged stay in the United States, principally in New York, the author describes and evaluates the usual methods of examination and treatment of the phorias.

The tropias and phorias are defined and differentiated. Tests including the Maddox rod, cover and parallel tests for distance and near, are explained in detail. He suggests that convergence and divergence should be measured at 5 meters, and 30 centimeters. The importance of hygienic treatment is emphasized. The correction of hyperphoria is advised, and simple convergence and divergence exercises are explained.

The American methods are commented upon very favorably by the author and are here presented to French ophthalmologists. Charles A. Bahn.

Heim, M. **Nystagmus retractorius in encephalitis of Bang.** Ophthalmologica. 1945, v. 110, July-Aug., pp. 15-28.

Only fifteen cases of nystagmus retractorius have been published so far. There is a quick movement of the eyeball backward into the orbit followed by a slow passive return to its original position. The condition is always accompanied by a palsy of the elevators of the eyes that is usually supranuclear. The pathologic basis for the condition is damage by pressure or inflammation in the upper part of the posterior longitudinal bundle near the entrance of the aqueduct of Sylvius. The author observed a case of undulant fever of the Bang type, in which acute cerebral disturbances were found eight months after the infection. They included the above described symptoms and some associated nuclear disturbances of the eye muscles. Encephalitis in the tegmentum near the entrance to the aqueduct of Sylvius was assumed to be the cause in this patient, but recovery occurred in two weeks without adding new facts to the picture of nystagmus retractorius. All the cases described in the literature are summarized in the article. (Bibliography.)

Max Hirschfelder.

Hermann, K., and Hall, I. S. **Sphenoidal mucocele as a cause of the ophthalmoplegic migraine syndrome.** Trans. Ophth. Soc. U. Kingdom, 1944, v. 64, pp. 154-164.

The clinical diagnosis of the "ophthalmoplegic migraine syndrome" has been used when there is severe unilateral supraorbital pain followed by partial or complete homolateral oculomotor paralysis. The paralysis develops quickly and recedes gradually. With recurrent attacks regression of the ocular palsy becomes less complete until eventually a more or less complete palsy remains. Bramwell suggested that the origin of this syndrome is vascular. A leaking aneurysm, or an artery or an unruptured aneurysm may make transient pressure on the affected nerve. The authors have demonstrated by means of arteriograms that congenital basal cerebral aneurysm is the commonest cause of the ophthalmoplegic migraine syndrome.

They add a case report. A man had recurrent headaches since 1924. The headaches gradually became more frequent and with each one facial pain became more severe. Six months ago the left upper eyelid became involved and the vision became blurred. A mucocele of the sphenoid sinus was found and after an operation in which the anterior

wall of the cyst was removed recovery was rapid. (7 illustrations.)

Beulah Cushman.

5

CONJUNCTIVA

Freitas, Orlando de. **Bacterioscopic examinations of conjunctival secretions.** Arquivos do Instituto Penido Burnier, 1945, v. 7, Dec., pp. 179-195.

The results obtained from 3,445 bacterioscopic examinations of conjunctival secretions are analyzed. About one half the examinations were in cases of conjunctivitis and about one half preoperative. In the cases of conjunctivitis the predominant organism was the Koch-Weeks bacillus, with 16.8 percent, followed by the pneumococcus with 16.1 percent. In the preoperative cases, almost one half were negative, and the positive cases showed a predominance of diphtheroid bacilli and staphylococci. (4 graphs, references.)

W. H. Crisp.

Jackson, W. P. U. **The syndrome known as "Reiter's disease."** Brit. Med. Jour., 1946, No. 4466, Aug. 10, pp. 197-199.

The triad of polyarthritis of the large joints, nonspecific urethritis, and bilateral catarrhal or purulent conjunctivitis is nonvenereal and of undetermined etiology. Episcleritis and keratodermia blennorrhagia may also be part of the picture. Response to sulfadiazine therapy is good. Three cases are reported. I. E. Gaynon.

Jona, Sergio. **Reticulo-histiocytoma of the conjunctiva.** Rassegna Ital. d'Ottal., 1946, v. 15, March-Apr., pp. 81-93.

Tumors of the reticulo-endothelial system are rare and only two previous cases of this neoplasm have been reported as occurring in the conjunctiva. Certain conditions are necessary to make the diagnosis: cells which are morphologically mesenchymal, intimate relation to the supporting fibers, phagocytic properties, and evolution towards a pluricellular type.

Jona's patient was a man, 64 years of age whose left eye showed a thick tumor of the bulbar conjunctiva of the left eye of two years duration. He concludes that such tumors result from a proliferation of the peri-adventitia of the blood vessels. Eugene M. Blake.

Mihalyhegyi, G. **A new contribution to the origin of the abscess in the bulbar conjunctiva.** Ophthalmologica, 1945, v. 109, Apr.-May, pp. 265-268.

Abscesses in the bulbar conjunctiva are rare. They usually occur around foreign bodies or in cases of septicemia. The author observed a patient who developed an abscess of the bulbar conjunctiva after a hordeolum, obviously through contact with the infected tissue. Max Hirschfelder.

Svoboda, J. **Further experiences with the implantation of buccal mucosa in eye diseases.** Casopis Lekaru Ceskych, 1946, v. 85, June 14, pp. 797-800. (See Section 6, Cornea and Sclera.)

6

CORNEA AND SCLERA

Alberstadt, N. F. and Price, A. H. **Corneal ulcer treated with streptomycin.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1106-1111. (References, 1 table.)

Allenic. **Local sulfonamide therapy in hypopyon ulcers.** Ann. d'Ocul., 1945, v. 178, Dec., pp. 561-566.

The author has employed sulfonamide powder satisfactorily in infectious ulcers since 1942. He uses local anesthesia but avoids the excessive use of cocaine. Two sulfonamide applications are used daily. In three years no enucleations have been found necessary in corneal ulcers, except in eyes that were lost when first seen.

In hypopyon ulcers with lacrimal impermeability and infection, in herpes, spring catarrah, and in rodent ulcers, this treatment was used as an adjunct to other therapy.

More rapid cicatrization with less degeneration apparently followed powdered sulfonamide therapy. The most favorable reactions were observed in infected phlyctenular ulcers. Subconjunctival injection of sulfamids is not advised because of frequent hemorrhage. Five illustrated cases are described. Charles A. Bahn.

Bilger, I. **A case of epibulbar carcinoma.** Göz Kliniği, 1946, v. 3, no. 6, pp. 94-101.

A 38-year-old man was struck in the left eye by a branch. One year later a papillary neoplasm developed at the limbus. The tumor was not deeply attached and was removed surgically. Histologic examination revealed a cornified epithelial carcinoma. There was no recurrence after one year.

I. E. Gaynon.

Blaine, G., Dollar, J. M., Sorsby, A. **The use of plastic materials for scleral wounds.** Trans. Ophth. Soc. U. Kingdom, 1944, v. 64, p. 187.

The authors report on the use of plastic materials in the treatment of scleral wounds. Fibrinogen plastic, calcium algenate, and methyl methacrylate were used.

They concluded that an inert nonabsorbable substance does not influence wound healing in the sclera. Absorbable plastic materials such as fibrinogen and, to a lesser extent calcium alginate exercise a favorable influence.

Beulah Cushman.

Bruechner, R. **A case of Sjögren's syndrome, successfully treated with Perandren.** Ophthalmologica, 1945, v. 110, July-Aug., pp. 37-42.

Sjögren's syndrome, keratoconjunctivitis sicca, is associated with dryness in the naso-pharynx, achylia, and chronic arthritis. Elderly women are predisposed and it is not certain whether the condition is an avitaminosis or a disturbance of the organs of internal secretion. In a woman 47 years of age, the disease responded remarkably well to oral doses of male hormone (methyltestosterone, Perandren). Her symptoms immediately returned when this substitution therapy was interrupted and the patient improved with the return to the treatment. This observation makes a disturbance of the internal secretion seem probable. (Literature.) Max Hirschfelder.

Castroviejo, Ramon. **Indications and contraindications for keratoplasty and keratectomies.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1081-1089. (17 figures.)

Grossman, E. E. **Conjunctivitis associated with erythema multiforme bullosa.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1146-1149. (See section 17, Systemic diseases and parasites.)

Jona, S. **A study of the chemical nature of the Kayser-Fleischer ring by ultra-violet light.** Rassegna Ital. d'Ottal., 1946, v. 15, May-June, pp. 191-200.

Various theories as to the origin of the pigment in the Kayser-Fleischer ring are reviewed. Fleischer first stated that the source was not iron but probably biliary pigment. Later he concluded that it came from degenerated hemoglobin. Rumpel and Söldner stated that the color of the ring was due to silver, and Kubik found spectroscopically that it was urobilin. Copper was also considered to be the source of the color. Jona studied a case by filtered ultra-violet light and concludes that the pigment is neither copper nor urobilin but probably a complex organic substance not definitely determined.

Eugene M. Blake.

Klar, R. **Corneal involvement in vernal conjunctivitis.** Klin. M. f. Augenh., 1943, v. 109, May-June, p. 385.

In a man, 22 years of age, who had suffered from the palpebral type of vernal conjunctivitis for seven years, small proliferations occurred at the limbus during one recurrence. At the same time punctate and comma-shaped subepithelial and epithelial grayish-white opacities that could be stained with fluorescein appeared in the center of the cornea. Treatment consisted of dry hot applications and 3-percent boric acid ointment. The foci gradually coalesced and other punctate and elongated opacities developed near the periphery. In the vicinity of the circumscribed limbal proliferation no corneal lesions were seen. The process healed completely without leaving permanent opacities. (References.)

F. Nelson.

Kuo, P. K. **Incipient pannus as a sign of the primary corneal infection of trachoma and as an important criterion for the early diagnosis of the disease.** Amer. Jour. Ophth., 1946, v. 29, June, pp. 645-654. (5 figures, 3 tables, references.)

Larsen, Victor. **Eye diseases caused by hydrogen sulphide in tunnel workers.** Acta Ophth., 1944, v. 21, pt. 4, pp. 271-286.

During the construction of a tunnel under the Sund fifty workers suffered from 163 attacks of acute keratitis with severe pain, photophobia, lacrimation, and the development of corneal vesicles which ruptured within 24 hours. Thorough investigation revealed that the exciting agent was hydrogen sulphide, liberated from the decay of organic substances at the bottom of the sea and from anaerobic fermentation. The ocular symptoms became more severe after the men returned to fresh air, because hydrogen sulphide has a slight anesthetic action. These attacks were finally eliminated by ventilation sufficiently powerful to drive out the gas. Ray K. Daily.

Lutman, F. C. and Favata, B. V. **Keratoconjunctivitis sicca and buccoglossopharyngitis sicca with enlargement of parotid glands.** Arch. of Ophth., 1946, v. 35, March, pp. 227-240. (See Section 14, Eyelids and lacrimal apparatus.)

Magitot, A. **Allergic conjunctivitides and keratitides.** Ann. d'Ocul., 1945, v. 178, Aug., pp. 321-334. (See Section 5, Conjunctiva.)

Malling H. **Congenital parenchymatous (non-luetic) keratitis.** Acta Ophth., 1944, v. 22, pt. 2, pp. 141-146.

Two cases are reported and a similar observation reported by Tertsch is briefly referred to. An infant was seen when one month old, with a bilateral corneal affection resembling parenchy-

matous keratitis. The lesion was characterized by scattered, fairly massive, diffuse grayish spots in the corneal parenchyma, and deep vessels extending 1 to 3 mm. into the cornea. The left cornea was macerated with large epithelial erosions, especially in the center. Several months later the lesion had healed. The right cornea was left with a few scattered nebulae and the left with dense central maculae. The other patient, a woman 40 years of age, had massive, smooth, irregularly circumscribed maculae in the lower portion of each cornea, distortion of the pupils, and left anterior polar cataract in the left eye. The pathogenesis of the affection is discussed, and it is believed that it is an extrauterine inflammatory affection. (Illustration.) Ray K. Daily.

Mann, Ida, Pirie, A., Tansley, K., and Wood, C. **Some effects of vitamin-A deficiency on the eye of the rabbit.** Amer. Jour. Ophth., 1946, v. 29, July, pp. 801-815. (1 color plate, 2 charts, 2 tables, 6 figures, references.)

Odegaard, Kristian. **Purulent conjunctivitis with keratitis caused by Neisseria intracellularis (meningococcus).** Acta Ophth., 1944, v. 21, pt. 4, pp. 295-302. (See Section 5, Conjunctiva.)

Owens, W. C. **Streptomycin treatment of a corneal abscess caused by escherichia coli.** Amer. Jour. Ophth., 1946, v. 29, August, pp. 1007-1009. (References.)

Panzardi, D. **The Stähli's corneal line in trachomatous patients.** Boll. d'Ocul., 1944, v. 23, July-Sept., pp. 195-205.

With the slit lamp the writer systematically studied the condition of the cornea of 100 patients with old trachoma. In all of them there was superficial linear horizontal pigmentation in the lower half of the cornea that resembled the senile line of Stähli. The line had a decided horizontal course and was curvilinear or broken. The position of the line corresponds to the palpebral fissure through which an irritating substance or evaporation could cause further damage to the already badly affected cornea. (Bibliography.)

Melchiore Lombardo.

v. Papolczy, F. **Pathogenesis and therapy of serpiginous corneal ulcer.** Klin. M. f. Augenh., 1943, v. 109, May-June, p. 361.

Serpiginous corneal ulcer can occur at any age and in both sexes. The incidence is higher in males (65 percent) and after 40 years of age. Coexistent dacryocystitis was observed in 25 percent of patients. In 25.34 percent of the patients pneumococci were found, in 36.9 percent staphylococcus albus, and less commonly staphylococcus aureus, diplobacillus, streptococcus, and xerosis bacillus. Even the last species can produce the disease. It is recommended that cultures be taken not only from the secretion of the conjunctival sac but also from the ulcer itself. Local treatment with wetol, a preparation of vitamins A and D and iodine in linseed oil or cod-liver oil, proved most beneficial. The author used a mixture of equal parts of wetol and cod-liver oil, which is not only a strong antiseptic but also a stimulant of tissue growth. In addition he advocates such surgical procedures as cautious removal of the overhanging edge of the ulcer, cauterization, removal of exudate from the anterior chamber, trephining, and paracentesis. (References.)

F. Nelson.

Pavisic, Z. **Treatment of serpiginous ulcer with the sulfapyrimidine prepara-**

tion "Debenal." Ophthalmologica, 1945, v. 109, Apr.-May, pp. 227-235.

Fourteen cases of serpiginous ulcer of the cornea which were treated orally with sulfapyrimidine are reported. The results were satisfactory in ulcers that were not too far advanced. The drug was well tolerated by the patients, all of whom were over 47 years of age. Only in far advanced ulcers were other measures such as steam cautery and conjunctival covering necessary. The literature on the subject of local and general sulfonamide therapy of serpiginous ulcers is briefly reviewed. (Bibliography.) Max Hirschfelder.

Pirie, A. **Ascorbic acid content of cornea.** Biochem. J., 1946, v. 40, no. 1, pp. 96-100.

The ascorbic acid content of corneas of cattle and rabbits was determined when excised immediately after death, and after chemical damage had had time to occur. The concentration in the epithelium was found to be much higher than in the stroma. About one half the total amount of ascorbic acid in the cornea was found in the epithelium. The amount in the stroma was about equal to that in the aqueous. It was deduced that the endothelium is permeable to ascorbic acid. After injury with ββ′-dichlorodiethyl sulphide the concentration of ascorbic acid in the cornea was decreased. (5 tables, references.) Bennett W. Muir.

Richards, J. M. and Romaine, H. H. **Keratoconjunctivitis sicca.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1121-1125. (See section 17, Systemic diseases and parasites.)

Riise, Per. **Transplantation of the entire cornea.** Acta Ophth. 1943, v. 21, pt. 1-2, pp. 26-30.

In two eyes in which the cornea had been lost through a serpiginous ulceration so severe that iris and lens were exposed, an entire cornea was implanted. In one case the implant was taken from a cadaver, and in the other from an eye enucleated because of a choroidal tumor. Both implants took. Five months after the transplantation one cornea was opaque peripherally, but clear enough in the center to permit visibility of the pupil. Vision was hand movements in front of the eye. The second case was in its ninth postoperative day when this report was made. (2 photographs.)

Ray K. Daily.

Rønne, Henning. **Xerophthalmia in Denmark in the period 1882-1942.** Acta Ophthal., 1944, v. 22, pt. 3, pp. 237-242.

A graphic survey points out the close relation between the incidence of the disease and lack of vitamin A in the diet. Ray K. Daily.

Sezer, D. N. **Hereditary corneal dystrophy.** Oto-Nöro-Oft., 1946, v. 1, pp. 6-15.

The author reports the first three cases of corneal dystrophy in Turkish literature. In a man, 45 years of age, white subepithelial plaques coalesced to form a discoid opacity in the central area of each cornea. In a man 24 years of age, who had complained of poor vision for five years, biomicroscopic examination revealed many small brown and gray opacities of varying size in the superficial layers of the parenchyma in the pupillary area of each cornea. The epithelium was irregular and nodular. In the third case a man 21 years of age complained of decreased vision, pain and photophobia. The entire cornea seemed veiled owing largely to the

increased reflection in the region of Bowman's membrane. I. E. Gaynon.

Smith, Arthur. **Survey of the treatment of traumatic corneal ulcer. 1941-1944, Royal Hospital, Sheffield.** Brit. Jour. Ophth., 1946, v. 30, March, pp. 178-186.

By means of graphs 262 cases of corneal ulcers are analyzed. Annual incidence, age, length of stay in hospital, visual acuity, and vision as related to age are considered. Treatment consisted of intravenous protein therapy combined with internal sulfonamide administration. Cauterization was purposely omitted and results were uniformly good. Morris Kaplan.

Summers, T. C. **Penicillin and vitamin C in the treatment of hypopyon ulcer.** Brit. Jour. Ophth., 1946, v. 30, March, pp. 129-134.

Twelve cases of hypopyon ulcer are reported. Treatment consisted of immediate cauterization, instillation of penicillin (200 units per c.c. every hour during the day and every three hours during the night) and atropine, the constant use of a hot pad, short wave diathermy, and an injection of 500 mg. of vitamin C. Results were much superior than with regimens previously used. The author believes that penicillin and vitamin C combined are considerably more effective than either alone. (13 colored illustrations.)

Morris Kaplan.

Svoboda, J. **Further experiences with the implantation of buccal mucosa in eye diseases.** Casopis Lekaru Ceskych, 1946, v. 85, June 14, pp. 797-800.

Implantation of buccal mucosa according to Denig was carried out in 47 patients with trachomatous pannus. Of 22 who were examined one year after the operation, irritation was present in two and six had recurrence. Of 114 patients operated upon for pterygium, seven had insufficient cosmetic improvement and seven had recurrence. Sixteen patients were treated by this method for burns with satisfactory outcome in all but two. O. Felsenfeld.

Thomas, C. I. **Corneal transplantation and preliminary iridectomy.** Arch. of Ophth., 1946, v. 35, Feb., pp. 170-172.

Iridectomy is recommended as a preliminary to the corneal transplantation operation for the following reasons: it enables the surgeon to estimate the amount of postoperative reaction that may follow; it allows for more rapid refilling of the anterior chamber; a prolapse of the iris into the wound after the transplantation is less likely. Iridectomy may prove dangerous and should be approached with caution in an eye which has the relatively unfavorable, deeply scarred, somewhat vascular cornea and in which, when the anterior chamber is opened, the iris is found to be smooth and bound down tightly to the lens. Loss of vitreous frequently follows an attempt to do an iridectomy in such an eye.

John C. Long.

Valerio, M. **Keratitis sicca and keratitis filamentosa.** Rassegna Ital. d'Ottal., 1946, v. 15, March-Apr., pp. 144-151.

Keratoconjunctivitis sicca is simply the expression of the corneal and conjunctival alterations which are the natural consequence of a destruction of the secretory tissues of the lacrymal gland, and independent of the factors which cause this destruction. The presence or absence of filaments upon the

cornea has no particular significance, except that it is one of the principal causes of the patient's discomfort. There is another form of filamentous keratitis, that is seen in herpes of the cornea. Eugene M. Blake.

Verdaguer, Juan (P). **Therapy of superficial keratitis.** Arch. Chilenos de Oft., 1945, 1st yr. May-June, July-August, nos. 6 and 7, p. 13.

The subject is discussed under the following heads; morphologic description of epithelial keratitis, etiology of superficial keratitis, infectious keratitis, degenerative keratitis, relapsing erosion of the cornea, other indications for subconjunctival autohemotherapy.

W. H. Crisp.

Werner, K. **The treatment of serpiginous corneal ulcer with the sulfonamid preparation Cibazol.** Klin. M. f. Augenh., 1943, v. 109, May-June, p. 376.

Of 30 serpiginous ulcers that varied in size from 1.5 to 6 mm., 27 were treated successfully with cibazol given internally. Locally only scopolamine was instilled. The patients were kept in bed and the diseased eye was bandaged with a metal shield. Fifty percent of the eyes were infected by pneumococci, the remainder by staphylococcus pyogenes aureus and citreus, xerosis bacillus, streptococcus viridans, and colon bacillus, either alone or as part of a mixed infection. The average stay in the hospital was eight to nine days. Two patients were treated ambulantly. Two of the three eyes that did not respond to the treatment became blind from spontaneous perforation, and in one resistent recurrences made electrocauterization necessary. No surgical methods except extirpation of infected tear sacs were used. Resulting vision in nine patients was 1.0, in 11 it was between 0.5 and 0.9, and in five it was less than 0.5. (References.)

F. Nelson.

Woods, A. C. **Nummular keratitis and ocular brucellosis.** Arch. of Ophth., 1946, v. 35, May, pp. 490-508.

In a previous paper published in collaboration with Guyton, it was suggested that in some instances the nummular keratitis of Dimmer, might be due to an infection with Brucella. Several further observations have been made which strengthen this opinion. The clinical and experimental observations which prompt this belief are presented.

A complete discussion of the history of the terminology is given.

The confused literature on nummular keratitis suggests that more than one clinical entity may have been described under this term. Five isolated, sporadic cases are reported. In all of the patients the classic picture of nummular infiltrates in the cornea and, likewise, serologic or allergic evidences of brucellosis were present. A typical nummular keratitis can be produced in experimental animals by proper inoculation of the eyes with Brucella organisms. It seems probable that some of the nummular keratitis reported may actually have been corneal brucellosis. The term Brucella nummular keratitis is suggested. R. W. Danielson.

Effect of antiseptics on regeneration of corneal epithelium. Bull. U. S. Army Med. Dept., 1946, p. 257.

The corneal epithelium was rubbed off by gauze in the previously cocainized eyes of a number of adult rabbits. The right eyes of the rabbits were treated with normal saline solution in a quantity similar to the drug solutions used in the left eyes. The solutions used

in the left eyes were: aqueous solutions of mild silver protein, 10-percent; zinc sulfate, 0.5-percent; mercurochrome, 2-percent; phemerol, 1:2,500 in 2-percent boric acid solution; mercuric oxycyanide 1-5,000; metaphen 1-2,500; merthiolate 1-2,500; acriflavine 1-1,000; zephrian chloride 1-3,000; penicillin 2,500 oxford units per c.c.; and sodium sulfathiazole, 2-percent.

During the first 24 hours the right and left eyes of each rabbit had equally hazy corneas and equal conjunctival congestion. Within four to six days the right eyes were clinically normal, whereas the left eyes had large denuded areas.

The investigators concluded that the local antiseptics ordinarily used in ocular therapeutics considerably delayed the healing process in the corneal epithelium of rabbits. In most instances the use of these drugs resulted in a permanent opacity of the cornea. The histologic changes in all the corneas that were examined were alike, which suggests that all the chemicals produced the same nonspecific irritation. Sodium sulfathiazole and penicillin neither delayed regeneration nor produced opacities.

The authors feel that the use of common local antiseptics should be limited to those injuries in which there is a probability of infection. F. M. Crage.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Atkinson, Donald. **The artificial pupil in the restoration of vision.** J. Internat. Coll. Surgeons, 1946, v. 9, May-June, pp. 365-369.

The author presents four cases and discusses his simplified method of creating an artificial central opening in the iris in aphakic eyes in which the pupil has been sealed by exudates. This consists of a corneal section in which the knife, cutting edge downward, is made to penetrate the cornea 4 mm. from the limbus, after which it is forced through the iris and passed forward 6 mm. where it again enters the anterior chamber. The counter puncture in the cornea is made and the section is not finished, as the elasticity of the iris will cause a coloboma to occur. The knife is then withdrawn. (Four figures.)

I. E. Gaynon.

Emmelin, N., and Palm, E. **On the presence of histamine in aqueous humor.** Acta Ophth., 1944, v. 22, pt. 2, pp. 117-130.

The material for this laboratory investigation consists of the aqueous of the cat, dog, rabbit, and ox. The intestine of the guinea pig was used as the test material, for histamine produces muscular contraction. The data, reported graphically, show that a biologically active substance is present in the aqueous of these animals, which causes histamine-like contraction of the guinea-pig intestine and a bronchial constriction. The substance producing these reactions is destroyed by boiling in alkaline, but not in acid solution. The effect on the guinea pig intestine is counteracted by thymoxietyldietylamine but not by atropine. The intravenous injection of histamine raises the blood histamine content but does not increase the histamine content of the aqueous. Ray K. Daily.

Esteban, Mario. **A rare postoperative complication: iridocyclitis from penetration of a greasy substance into the eye.** Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, May, pp. 378-384.

A postoperative iridocyclitis beginning on the eighth day after an uncomplicated intracapsular cataract extraction is reported. The eye was very painful for more than two months. A small globule of grease was noted on the hyaloid membrane with the slit lamp. It was thought to be a particle of ointment that had been introduced into the eye at the time of operation. Chemical irritants given off by the grease caused the iridocyclitis. The particle was not absorbed but eventually seemed to be at least partially encapsulated by fibrin from the iris. J. Wesley McKinney.

Franceschetti, A., Valerio, M., and Babel, J. **Recurrent aphthous uveitis with mucocutaneous lesions.** Arch. of Ophth., 1946, v. 35, May, pp. 469-489.

During the last few years a new syndrome has been described in the European literature of dermatology and ophthalmology, a syndrome characterized by periodically recurring uveitis and a group of mucous and cutaneous symptoms.

The clinical evolution of this disease is characteristic. It affects young people, generally between the ages of 20 and 30 years, and evolves slowly over a period of years. The illness is essentially characterized by its recurrence, and expecially by the periodicity of the attacks.

The beginning of the illness is insidious and is characterized by the sudden appearance of banal buccal aphthae. Uveitis is in general the characteristic and dominant feature of the syndrome. No specific or valuable treatment has been found.

The authors report five cases in detail and discuss the various theories of etiology. Of the various hypotheses, that of a virus infection seems the most probable, although it is necessary to introduce another factor, which is the sensitization of the organism. This allergy, however, seems to be secondary, and not the initial cause of the disease as in the analogous ocular disorders of the rheumatic type.

The extremely frequent coexistence of gastrointestinal disturbances should be remembered. (57 references and 4 figures.) R. W. Danielson.

Godtfredsen, Erik. **The frequency of secondary carcinomas in the choroid.** Acta Ophth., 1944, v. 22, pt. 4, pp. 394-400.

Six cases of metastatic choroidal tumor were found among 8,000 patients with cancer at the Radium Center. They constituted between one-third and one-half of the total number of intraocular tumors. Contrary to published data this investigation shows that metastasis in the choroid from pulmonary and mammary cancer is equally frequent. Ray K. Daily.

Godtfredsen, Erik. **Choroid metastases in chorionepithelioma of the testicle.** Acta Ophth., 1944, v. 22, pt. 3, pp. 300-310.

The literature contains five cases of ocular metastasis of a chorionepithelioma; three in women, and two in men. The author's patient a man, 18 years of age, died one year after the appearance of this tumor in the testicle and 20 days after the appearance of the ocular metastasis. Autopsy revealed metastases in the internal organs and cerebrum. (Microphotograph.)
Ray K. Daily.

Guglianetti, L. **A new symptom of sympathetic ophthalmia.** Rassegna Ital. d'Ottal., 1946, v. 15, nos. 1 and 2, p. 5.

Since sympathetic ophthalmia manifests itself predominantly in the an-

terior segment or the posterior segment of the eye, Guglianetti inquired whether there might be early changes in the field of vision which would be diagnostic. Using the Maggiore perimeter and reduced illumination he found an annular scotoma between the macula and the periphery both for white and colored test objects in two patients. A third patient revealed a ring scotoma about the macula very early in the course of the disease. Further studies are necessary to determine the value of this test. Eugene M. Blake.

Haar, M. **Reiter's disease.** Acta Ophth., 1945, v. 23, pt. 2, pp. 143-150. (See Section 5, Conjunctiva.)

Hebert, Emile. **An exceptional complication of furunculosis.** Ann. d'Ocul., 1945, v. 178, Dec., pp. 556-560.

A man, 25 years of age, with anthrax, developed a furuncle in the left nose with ocular redness, and iritis in left eye. One week later the anterior ocular inflammatory symptoms subsided. A white spot as large as the optic disc and a small hemorrhage were observed near the macula. Choroidal detachment in one of the upper quadrants in each eye followed probably as a result of a choroidal lesion. One month later the detachment had completely disappeared in the right eye, but not in the left eye. Sulfonamides were not well tolerated. Two months later only photophobia and small spots in the retina with slight striation persisted. The sudden onset, normal tension, and normal transillumination made choroidal tumor seem unlikely.

Pathologically the condition was a staphylococcus septicemia involving the orbit and uveal tract with a bilateral choroidal detachment. The detachment was attributed to suprachoroidal inflammation. Choroidal detachment is not infrequent after introacular operations and usually becomes reattached without serious complications.

Charles A. Bahn.

Herrmann, Heinz. **Enzymatic oxidations in ciliary processes.** Bull. Johns Hopkins Hosp., 1946, v. 78, March, pp. 119-125.

Separated fractions of the cell debris of the epithelium of the ciliary processes were studied for their chemical composition and their enzymatic activities. Marked differences were found in both these factors. Different types of granules contain enzyme aggregates of different composition which could vary the local variation of cellular metabolism. Francis M. Crage.

Krause, A. C. and Smith, L. F. **The therapeutic treatment of uveitis associated with toxoplasmosis.** Amer. Jour. Ophth., 1946, v. 29, August, pp. 977-980. (References.)

Larsson, S., and Osterlind, G. **Studies into the causes of senile miosis and rigidity of the pupil.** Acta Ophth., 1943, v. 21, pt. 1-2, pp. 1-25.

The authors review the literature and report 14 cases which they investigated. The 14 patients, 69 to 85 years of age, were subjected to a detailed preoperative biomicroscopic examination of the rigidity and structure of the iris. Most of the eyes had a more or less pronounced depigmentation of the free iris border, and in a number of cases the depigmented border was transformed into a structureless grayish-white homogeneous membrane. These changes in the iris had no definite relation to the degree of pupillary mobility, and were

not proportionate to the extent of histologically verifiable hyaline degeneration in the iris.

Segments of iris were excised and examined histologically.

The histological changes were principally sclerosis of the iris vessels, and more or less extensive hyaline degeneration near the free pupillary border and in the connective tissue layer between the sphincter and the pigment epithelium. The extent of these changes appeared to be in close relation to the degree of pupillary mobility. Atrophy and degenerative processes in the sphincter and dilator of the pupil were found in a number of the iris segments, and it seems certain that extreme rigidity of the pupil is always associated with these changes in the iris musculature. The anatomical background of senile miosis is thus shown to be primarily arteriosclerosis of the vessels of the iris, hyaline changes of the stroma, and degeneration of the musculature. Each one of these changes will make normal dilatation more difficult, but not impossible. All the changes combined and in advanced stages result in complete immobility of the pupil.

Ray K. Daily.

Lund, Axel. **Chronic iridocyclitis.** Acta Ophth., 1944, v. 22, pt. 2, pp. 176-192.

The case histories of 88 patients treated at the Finsen Institute were analyzed for data on the effectiveness of the treatment, etiology, and prognosis. The average period of observation was five years. The treatment consisted principally of carbon arc light baths and injections of tebeprotein. Thirty patients were men and 58 women. The morbidity is greatest between the ages of 20 and 30 years, and in women there is a rise in the morbidity near the age of 50 years. The average duration of the disease was 14½ months; it had a marked relation to the age of the patient at the onset of the disease; 39 months for patients under 20 years of age, and 7 months for people over 50. Of 151 eyes 136 became quiescent, although there were relapses in 56 eyes. As a rule the relapses were mild. Nearly one half of the eyes recovered with normal vision. Sixty-three percent had good reading vision, and 23 percent had orientating vision. The poor visual results were due to complications, such as secondary glaucoma, central lesions, optic neuritis, retinal detachment, and cataract. In all patients except those who had cataract the poor visual results were irreparable. Nine patients with a cataract were operated upon; in five the result was good reading vision. In one there was a recurrence of the inflammatory process. One half of the patients had roentgenographic evidence of lesions in the lungs.

Ray K. Daily.

Marback, H. **Spontaneous cyst of the iris.** Arquivos Brasileiros de Oft., 1946, v. 9, Feb., pp. 1-9.

A woman, aged 27 years, came complaining of a small spot on the right iris, said to have been noticed only for the past 12 years. The eye was normal in every other respect and the visual acuity was 1.0. The iris moved freely. The pupil was slightly oblong. In the anterior chamber, in the region of the chamber angle between the 9:30 and the 10:30 o'clock positions, was seen a small cyst, hemispherical in form, and whose radius was from 1.5 to 2 mm. in length. Dilatation of the pupil demonstrated the absence of synechia. Under the biomicroscope, the walls of

the cyst were transparent and extremely thin. There were two small pigmented areas in the posterior wall, and the anterior wall contained meshes of iris stroma and was traversed by capillaries. The patient was urged to undergo excision of the cyst by means of an iridectomy, but refused such action on account of the abscence of inconvenience from the cysts. After 2½ years no appreciable change was discovered in size or appearance of the cyst. (References.) W. H. Crisp.

Matthews, G. W. and Hollabaugh **Uveitis with secondary glaucoma.** Bull. U. S. Army Med. Dept., March. 1946, p. 364.

A white male, aged 42 years, was hospitalized for a painful, moderately congested left eye. The vision was 20/200, tension (Schiotz) 40 mm., the vitreous was cloudy, and the cornea had a few deposits on its posterior surface. There was no visible choroidal lesion. The diagnosis was acute uveitis with secondary glaucoma.

Laboratory tests and clinical examinations were negative. X-ray films revealed a small lower fourth molar completely covered by bone. After removal of the tooth caseous exudate escaped. Adjacent to the tooth and posterior to it was a large rough cystic sac.

Two days after operation the eye was free from pain, and tension was 20. Two weeks later the vision was 20/30 and the eye was normal except for a few vitreous opacities. F. M. Crage.

Olsson, G. F. **A common species of clinically observable spontaneous cysts in the anterior uveal tract.** Acta Ophth., 1944, v. 22, pt. 4, pp. 319-340.

The literature is reviewed and 15 cases of spontaneous cysts situated on the posterior surface of the iris are reported. Twelve of the patients were women, and no patient was older than fifty years. There were no symptoms of irritation. The cysts produced a slight elevation on the anterior surface of the iris, and they could be seen on the posterior surface only after maximal dilatation of the pupil. The pigmentation of the walls of the cysts varied in intensity from slight to very great. The origin of the cysts is discussed; the author believes that the faintly pigmented ones originate from a circumscribed separation of the limitans iridis, and the highly pigmented cysts are formed by the pigment epithelium. Usually no therapy is indicated. (2 photographs.) Ray K. Daily.

Pirie, A., and Simpson, D. **Preparation of a fluorescent substance from the eye of the dogfish, Squalus Acanthias.** Biochem. J., 1946, v. 40, no. 1, pp. 14-20.

A method is described for the preparation of a blue fluorescent material that is largely confined to the choroid, with perhaps traces in the iris. Chemical and spectroscopic evidence makes it probable that the substance is xanthopterin and not ichthyopterin. A similar substance was found in the eyes of Alligator Mississipiensis. The presence of guanine in the choroidal tapetum was confirmed. (1 figure, 1 table, references.) Bennett W. Muir.

Vidal, F. and Malbrán, J. **Studies on the chemical composition of the aqueous humor of the cat. VII. pH.** Arch. de Oft. de Buenos Aires, 1943, v. 18, Oct., p. 506.

The authors studied the pH of the aqueous humor of the cat. The determinations were calculated with v. Brehmer's hemo-ionometer using an electrode of quinidrone which allows

measurements of the pH between 6 and 8.5. The average figure in 19 eyes was 7.51 for aqueous of first formation and 7.52 for aqueous of second formation. The pH of the aqueous humor in cats is more alkaline than that of the blood in the same animal. Under abnormal conditions the authors obtained slightly higher figures, 7.55 and 7.57. (Tables, bibliography.) Plino Montalván.

Zeeman, W. P. C. **The diagnosis of a flat sarcoma of the choroid and the histological substratum of the changes observed with the ophthalmoscope.** Acta Ophth., 1943, v. 21, pts. 1-2, pp. 47-60.

A clinical and histo-pathological report of a case, correlating the ophthalmoscopic picture with the microscopic changes. Reference is made to a case reported by Meller as a pseudosarcoma choroidea and the correctness of his diagnosis is questioned. To support his contention that Meller's case was a sarcoma the author describes and illustrates the microspic findings in an enucleated globe similar to the one reported by Meller. In this case the extension of the tumor along a ciliary nerve left no doubt as to its identity. (8 illustrations.) Ray K. Daily.

8

GLAUCOMA AND OCULAR TENSION

Cristini, G. **Alterations of general arterial pressure as a factor in the causation of glaucoma.** Rassegna Ital. d'Ottal., 1946, v. 15, March-Apr., pp. 125-143.

Cristini stresses the need to study the variations of the general circulation in the evaluation of the tension in glaucoma. He reviews the present knowledge of the circulatory and nervous physiology of the uvea and its relationship to the regulation of the tension of the eye. Twenty patients with glaucoma were tested. The systolic blood pressure and the ocular tension after inhalation of amyl nitrite, after withdrawal of 500 c.c. of blood, and after compression of the eyeball were recorded. The author concludes that alterations in both the arterial and venous vessels of the uvea are fundamental causes of chronic glaucoma. This hypothesis is supported by the diverse response to hypotensive substances in glaucoma patients.

Eugene M. Blake.

Gallenga, Riccardo. **Operative treatment of hydrophthalmos.** Rassenga Ital. d'Ottal., 1946, v. 15, May-June, pp. 161-164.

The writer finds that the removal of the lens is the best treatment for congenital glaucoma. After dilating the pupil with atropine he divides the capsule and lens fibers with a double-edged knife. Four to eight days later he extracts the swollen lens matter by aspiration, through a small opening at the limbus above. For anesthesia chloral hydrate and a retrobulbar injection of novocain without adrenaline are used.

Four patients were operated upon by the above technic with satisfactory results and all were under four years of age. Gallenga feels that the lens is an etiologic factor in buphthalmos, and its removal is indicated for the same reason that this treatment is helpful in congenital aniridia and in high myopia.

Eugene M. Blake.

McDonald, Phillip Robb. **Treatment of glaucoma with di-isopropyl fluorophosphate.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1071-1081. (9 figures, 1 table, references.)

Oezerengin, T. **Two cases of congestive glaucoma with acute rheumatism.** Göz Kliniği, 1945, v. 3, no. 3, pp. 35-39.

The author presents his observations on two women who developed congestive glaucoma during their convalescense from acute rheumatism. One woman is suffering from "confusion of the endocrines" and the other hypertension. He believes the glaucoma is caused by an allergic response to the infection. I. E. Gaynon.

Penido Burnier, Jr. **Threshold of ocular tension.** Arquivos do Instituto Penido Burnier, 1945, v. 7, Dec., pp. 168-177.

A man aged 52 years came complaining of failing vision. The corrected vision of the right eye was 0.3, that of the left eye 0.7. Ophthalmoscopy showed marked excavation of the optic discs, extending to the disc margins and accompanied by pallor which was more evident in the right eye. The tension of the right eye with the Schiötz instrument was 17 mm., the tension with the McLean instrument 32 mm. The fields were somewhat contracted, and the right eye had a typical Bjerrum scotoma. Reduction of tension with miotics, to something like 3 or 4 mm. (Schiötz), caused some improvement in vision. (7 illustrations, including 4 pairs of visual fields.) W. H. Crisp.

Penido Burnier and Souza Queiroz. **Familial glaucoma secondary to spontaneous, homochronous, and hereditary dislocation of the crystalline lens.** Arquivos do Instituto Penido Burnier, 1945, v. 7, Dec., pp. 57-75.

The authors give the histories of four patients, three brothers aged 45, 65, and 50 years respectively, and a cousin of the three aged 52 years. All four developed subluxation of the crystalline lenses, followed by acute glaucoma. Iridectomy did not relieve the glaucoma, but the ocular tension became normal after extraction of the dislocated lens. On the whole the visual results were good after operation, although one patient was less fortunate in this respect because he at first refused extraction of the lens. The authors describe and illustrate the genealogic tree of the affected family, showing 11 positive out of 18 individuals in three generations. The authors agree with Vogt, who presented a similar family record, in attributing the spontaneous dislocation to presenile degeneration of the zonula, hereditary in character. Intracapsular extraction is regarded as the treatment of choice. (Bibliography.)

W. H. Crisp.

Regoli, Attilio. **The consensual ophthalmotonic reaction.** Boll. d'Ocul., 1944, v. 23, July-Sept., pp. 129-165.

A summary of the subject as it appears in the literature precedes the article. The author reports in tabulated form the results obtained in patients and rabbits. In his own experience the reaction manifests itself after such procedures as paracentesis of the anterior chamber, galvano-cauterization of the sclera, antiglaucomatous procedures, enucleation of the globe, and surgical procedures on the lacrimal passages. The reaction is probably a reflex phenomenon based on vascular changes which, through centers and associated fibers of a vasomotor system is transmitted consensually to the other eye. (Bibliography.)

Melchiore Lombardo.

Riise, Per. **Experiences with Holth's iridencleisis.** Acta Ophth., 1943, v. 21, pts. 1-2, pp. 31-46.

This is a detailed analysis of 199 iridencleisis operations performed on glaucoma patients. Normalization of tension, relation of tension to visible filtration, immediate and late postoperative complications, conservation of central and peripheral visual acuity, and postoperative refrative changes are considered. The material comprises acute, secondary, and chronic simple glaucoma, and its value lies in the fact that all the eyes were operated on and followed by one surgeon.

Ray K. Daily.

9

CRYSTALLINE LENS

Broendstrup, Poul. **Amblyopia exanopsia in infantile cataract.** Acta Ophth., 1944, v, 22, pt. 1, pp. 52-71.

The author reviews the literature and gives a detailed analysis of his own material which comprises 29 cases of unilateral spontaneous cataract, congenital or acquired before the tenth year, and 48 cases of unilateral traumatic cataract acquired before the tenth year. The data show that amblyopia exanopsia vitiates the surgical result of operation for cataracts acquired in early childhood. Functional amblyopia in infantile cataract is very widespread, and is not influenced significantly by removal of the cataract; uncorrected aphakia does not counteract the amblyopia, and may accentuate it. The prognosis for visual acuity is therefore not influenced by early or late operation. Amblyopia exanopsia is apt to develop as a sequel to traumatic anopsia incurred before the eighth year of life. If the cataract appears after the eighth year of life functional amblyopia is not apt to develop.

Ray K. Daily.

Broendstrup, Poul. **Operative results obtained in bilateral infantile cataract.** Acta Ophth., 1945, v. 23, pt. 2, pp. 175-194.

The literature is reviewed, and the author's material of 155 cases is subjected to a detailed analysis. The data show that bilateral infantile cataracts fall into two groups: stationary partial, and dense cataracts. There is danger of amblyopia exanopsia if partial cataracts are treated surgically too early. Infants with dense cataracts, if not operated upon early, will face the same fate as children born blind. Of 132 children with partial cataracts who were operated upon during their first school years 85 percent had a visual acuity of 6/18 or better during in the best eye. The best visual results were obtained in eyes in which good function could be determined preoperatively, and which were not operated upon too early. The results indicate that surgical intervention before the age of seven years may lead to irreversible amblyopia exanopsia.

There were 23 cases of bilateral congenital dense cataract. This type of cataract is frequently associated with other ocular anomalies that preclude good vision. Such eyes are apt to develop postoperative complications. A visual acuity of 6/36 is considered to be a good result. These patients should be operated upon at the age of one year, and should be given a refractive correction as soon as possible.

Ray K. Daily.

Broendstrup, Poul. **The squinting position of weak-sighted eyes.** Acta Ophth., 1944, v. 22, pt. 4, pp. 386-393. (See Section 4, Ocular movements.)

Gilje, Kristian. **Has saturation with ascorbic acid any influence upon hem-**

orrage after cataract operation? Acta Ophth., 1945, v. 23, pt. 2, pp. 127-134.

The material of this study consists of 45 patients who were operated upon for cataract during March, April, and May, 1941. The patients were saturated with ascorbic acid before operation and for 10 days after. No effect on the incidence of post-operative hemorrhage could be ascertained. The author's findings therefore do not confirm Urbanek's contention that saturation with ascorbic acid protects against postoperative hyphema. Ray K. Daily.

Mihalyhegy, G. **Foreign body injury of the lens.** Ophthalmologica, 1945, v. 109, Feb.-March, pp. 159-163.

A glistening foreign body was found in the lens of a non-irritated eye of a soldier after an explosion. X-ray examination was negative. It was found that the foreign body was gun powder which is insoluble in the aqueous and the tissue of the lens and, therefore, did no chemical harm. As the tear in the lens capsule closed immediately after the injury, no traumatic cataract ensued and final vision was 6/7.

Max Hirschfelder.

Rivas Cherif, Manuel de. **Anesthesia in the cataract operation.** Anales de la Soc. Mex. de Oft., etc., 1945, v. 20, July-Sept., pp. 93-102.

A general discussion of the varying practice of different authors regarding local anesthesia. W. H. Crisp.

Rocha, Martins. **Concerning microphakia.** Arquivos do Instituto Penido Burnier, 1945, v. 7, Dec., pp. 151-160.

The author records three cases, in a girl aged two years, and in two brothers aged respectively three and two years. Of the latter two patients the parents were first cousins and had three children. The lenses were extracted, apparently with good result. (3 figures, references.) W. H. Crisp.

10

RETINA AND VITREOUS

Andersen, O. C. **Three cases with remains of the hyaloid artery and anomalies of the retinal vessels.** Acta Ophth., 1944, v. 22, pt. 3, pp. 270-274.

The interesting feature of these cases is the inferior temporal direction of the vascular band, which is rare. In the first case there were also remains of the tunica vasculosa lentis on the posterior surface of the lens. The second case had two fibrous bands; in addition to the one coursing, through the vitreous, as is usual, there was another one situated on the surface of the retina. Such formations are very rare. In addition, these eyes also had anomalies of the fundus vessels. In the first patient there were no vessels in the fundus; in the second the arteries were very norrow and in the superior portion of the retina the vessels were scarce and thin. A similar fundus picture was seen in the third patient, except that the lower portion of the fundus was almost normal. The optic disc was pale in all of them and function was correspondingly reduced, no doubt because of the inadequate blood supply. Ray K. Daily.

Bangerter, A. **Contribution to the diagnosis, differential diagnosis and therapy of cystoid edema of the macula (macular cysts).** Ophthalmologica, 1945, v. 109, Feb.-March, pp. 102-122.

Macular cysts, the pathologic existence of which has been known for a long time, were first clinically recognized by Vogt who employed red-free ophthalmoscopy for their detection. He

described the clinical picture as "honeycomb macula". Whereas the usual ophthalmoscopic examination with white light reveals only the very advanced cystoid changes, it is possible to recognize very small and early cysts by slitlamp observation with use of the fundus contact glass. These small cysts are missed by any other method. The article describes in detail the slitlamp appearance of the cystoid macula and its differentiation from a hole in the macula and from the picture produced by degeneration due to sclerosis of the choroid. One group of Bangerter's patients with cystoid degeneration also showed senile choroidal sclerosis. It was in this group that a new treatment with retrobulbar injection of atropine sulfate (1 : 1000 solution, 0.3 to 0.6 c.c., two to four times per week for 12 injections) seemed effective. The author proposes this treatment with the idea that retrobulbar vasodilation improves the nutritional disturbance of the macular area which causes the formation of cysts. A second form of macular cysts was found in patients suffering from retinal detachment, branch thrombosis of retinal veins, retinitis pigmentosa, and inflammatory intraocular changes. These did not respond as regularly as those in the senile group to the treatment with retrobulbar injection of atropine. (Photographs, literature.) Max Hirschfelder.

Broendstrup, Poul. **Ablatio falciformis congenita.** Acta Ophth., 1944, v. 22, pt. 2, pp. 193-202.

In 1936 Weve reported under this name eight cases of a familial congenital anomaly. The characteristic feature of the anomaly is a double retinal layer which extends as a sickle from the papilla to the region between the ciliary body and the lens. The author reports the case of 4½-year-old girl who had this anomaly in the right eye, and a coloboma of the choroid in the left. (2 illustrations.) Ray K. Daily.

Brueckner, R., and Field, N. H. **Contribution to the complex of symptoms in chorioretinitis centralis serosa (Kitihara).** Ophthalmologica, 1945, v. 109, June, pp. 281-317.

Chorioretinitis centralis serosa is characterized by a sharply limited, flatly detached area in the macular region. The changes may be minute and the area has the form of a circle or of an elipse. Numerous small yellowish spots are usually found in the area after three to five weeks. Their histologic significance is not clear. The visual acuity is somewhat diminished, there is alteration in the sense of color perception, micropsia, and metamorphopsia. The condition usually clears up after weeks or months with complete return of the visual acuity. The existing relative central scotoma disappears. However, recurrences are common. The authors observed three patients who had the typical complex of symptoms and findings. They believe that edema has an important part in the pathogenesis of the condition and that it arises in the choroid, whereas the retina becomes detached and invaded by the fluid secondarily. It must be assumed that there is a pathologic change in the permeability of the capillaries of the choroid. No definite cause has been found nor has therapy been successful. The relative scotoma was extensively studied by one of the patients and his drawings which accompany the article are correlated with the clinical findings. There were certain unusual color images and afterimages

within the scotomatous area that varied during the clinical course depending on the intensity of the pathologic changes. With diascleral transillumination a positive scotoma appeared in the entoptic image. During autofundoscopy by the patients a small light reflex that changed its position with the moving of the transilluminating lamp, was noted in the positive scotoma. The authors call it the "entoptic reflex of convex retinal surface" and discuss its theoretical basis. (3 color plates, drawings, references.)

Max Hirschfelder.

Brueckner, R. **A case of thrombosis of the central retinal vein after a trauma.** Ophthalmologica, 1945, v. 109, Apr.-May, pp. 203-211.

A typical thrombosis of the central retinal vein was found in an eye that had suffered two contusions a few weeks before. It was assumed that the sudden increase of pressure in the central retinal vein lead to tears in its intima and gave rise to the slow formation of a thrombus. Brueckner discusses the physical and physiologic aspects that lead him to believe that there was a connection between the contusion and the thrombosis. The state insurance service recognized his considerations as a basis for assuming liability.

Max Hirschfelder.

Cardello, G. **A case of retinal periphlebitis.** Rassegna Ital. d'Ottal. 1946. v. 15, no. 1 and 2., p. 56.

The patient described was a 23-year-old woman whose physical and laboratory tests were all negative, except for a strongly positive tuberculin reaction. The retinal changes observed were sheathing, constrictions, and dilitations of the veins of medium and smaller caliber. Extensive hemorrhages were present but vision was 6/6. Tuberculin therapy was not feasible but recovery followed the use of calcium, arsenic, vitamin C, and auto-hemotherapy. Tuberculosis was the assumed cause. (4 figures.) Eugene M. Blake.

Colvin, Clifford. **Detachment of the retina.** M. J. Australia, 1946, v. 2, July 20, pp. 80-83.

The author discusses the etiology and pathology of retinal detachment. He recommends transillumination of all eyes. At operation the detached area of the retina is projected on to the sclera and marked with India ink. After the conjunctiva has been reflected, a spot of light from the ophthalmoscope is easily visible. A mark is made on the sclera 8.8 mm. from the limbus in the approximate meridian of the tear. Surface diathermy with the Larsson electrode is used. Case reports are included.

I. E. Gaynon.

Conte, W. R., McCammon, C. S., and Christie, A. **Congenital defects following maternal rubella.** Am. J. Dis. Child., 1945, v. 70, Nov.-Dec. p. 301.

The authors questioned the mothers of 120 infants who were born with congenital abnormalities during a five year period ending 1944. Of this group, five mothers reported having had rubella, four of them in the first trimester of pregnancy. Four of the five infants had congenital cataracts. The incidence of rubella in these mothers was at least ten times that of the rubella morbidity in the female adult population generally. It is felt that this constitutes evidence that rubella in pregnancy is a predisposing cause of congenital defects.

The authors found, as have all pre-

vious investigators, that most of the mothers reporting rubella had the disease in the first trimester of pregnancy.

Benjamin Milder.

Gil, R. R., and Blaza, J. F. **Retinal detachment in a pregnant woman.** Arch. de Oft. de Buenos Aires, 1943, v. 18, Oct., p. 531.

A case of retinal detachment occurring in the third month of pregnancy is reported. The pregnancy was uncomplicated and the eyes were highly myopic. The detachment was not related to the pregnancy. The patient was operated on and several diathermic punctures made to seal the retinal tears. Recovery was uncomplicated and vision was considerably improved. The pregnancy progressed to term uneventfully. (Illustrations and bibliography.)

Plinio Montalván.

Gradle, H. S. **Surgical treatment of retinal detachment.** Anales Argentinos de Oft., 1945, v. 6, Apr.-May-June, pp. 53-59.

The author feels that preoperative therapy is extremely important in achieving a satisfactory surgical result. For five to ten days the patient is immobilized in a position favoring approximation of the separated tissues, atropine is instilled, and the eyes are covered. Occasionally, even a satisfactory operation does not result in increased visual acuity, owing to macular degeneration or cyst formation. If the retinal tear is sealed, the chance for recovery is much enhanced, therefore, an intensive search for the site of a tear must be made. If a tear is not seem at first, it may appear at a later examination, after the patient has rested, because of a shift or absorption of subretinal fluid. The author prefers to use the electrodiathermy needle that he described in 1935. He makes a complete puncture of the sclera with a current of fifty to seventy milliamperes. He observes the fundus during this procedure, between penetrations, to make certain that they are properly placed. The sub-retinal fluid must be drained to achieve a proper chorioretinal cicatrix. Occasionally some months may pass before a good adhesion occurs, because of slow absorption of the remaining sub-retinal fluid. He reports good anatomic results in 54 to 74 percent of his operations, and good functional results in only thirty-seven percent in the past six years. (2 illustrations.)

Edward Saskin.

Hertzberg, R. **Quinine amaurosis. Report of a case.** M. J. Australia, 1946, v. 2, July 20, pp. 92-93.

The patient noted that after taking 50 grains of quinine sulfate, his vision became blurred and on the third day he was unable to see at all. Atabrine was substituted for quinine and the next day vision began to return. The pupils were dilated and immobile, there was edema of the macula in each eye and the fields were normal. Two days later the discs became pale and the arteries attenuated. After two weeks the visual acuity became 6/6 and the pupillary reactions normal, although the vessels were still attenuated and the discs pale.

I. E. Gaynon.

Lijó Pavia, J., and Lachman, R. **Macula. Small hole due to phototraumatism. Considerations on two cases.** Arch. de Oft. de Buenos Aires, 1943, v. 18, Oct., p. 496.

The authors report two cases of solar eclipse retinitis in which typical holes of the macula were observed. A small central scotoma with subnormal vision

remained after recovery. The literature on the subject is briefly discussed and the authors stress the traumatic action of light on the forvea when the luminous rays are converging on the macular region. The article is illustrated.

Plinio Montalván.

Lyle, D. J. **Early ocular manifestations in the Laurence-Moon-Biedl syndrome.** Amer. Jour. Ophth., 1946, v. 29, pp. 939-945. (1 table, 3 figures, references.)

Johnson, H. C. **Retinal venous sheathing in multiple sclerosis; report of a case.** Amer. Jour. Ophth., 1946, v. 29, Sept., pp. 1150-1151. (See section 17, Systemic diseases and parasites.)

Manschot, W. A. **The fundus oculi in subarachnoid hemorrhage.** Acta Ophth. 1944, v. 22, pt. 3, pp. 281-299.

The author reports three cases of subarachnoid hemorrhage accompanied by hemorrhages in the fundus of each eye. The eyeballs and optic nerves were examined microscopically, and Manschot finds in the microscopic picture an explanation for the extensive form which these hemorrhages assume in the retina, and which distinguishes them from the smaller retinal hemorrhages of different etiology. The anatomic data indicate that the hemorrhage is caused by a complete occlusion of the central retinal vein in the intervaginal space. The suddeness of the occlusion and the pressure within the optic nerve driving the venous blood in a retrograde direction creates such a high pressure within the retinal veins that they rupture and produce the large hemorrhages characteristic of subarachnoid hemorrhage. The smaller hemorrhages seen in thrombosis of the central retinal vein and in papilledema are formed by diapedesis in a slowly developing stasis in the retinal veins, which rarely causes their rupture. (5 microphotographs.)

Ray K. Daily.

Nyquist, B. **Two cases of retinitis as a complication in acute infections during chemotherapy.** Acta Ophth., 1943, v. 21, pt. 1-2, pp. 61-67.

One occurred in a patient whose erysipelas was treated with sulfanilamide. Blurring of vision occurred simultaneously with jaundice and exanthema after the patient ingested 7.5 gm. of the drug. The fundus had a small white spot up and temporally from the papilla. Recovery was complete, and treatment consisted in rest and dark glasses. The patient who had pneumonia, developed serious blurring of vision after taking 20 gm. of sulfathiazole in the course of five days. He had a bilateral central retinitis with large central scotomata. The exudates were gradually absorbed, and the final result was an absolute central scotoma one degree in diameter, and visual acuity of 5/35. (2 photographs.)

Ray K. Daily.

Nano, J. M., and Cuille, E. **Obstruction of the central artery of the retina not affecting the macular area.** La Semana Med., 1946, May 9, 53d yr. p. 835.

The macular area had escaped, as usual, on account of the existence of cilioretinal vessels. Retinal photographs show the contrast between the normal color of the preserved macular area and the pale edematous appearance of the rest of the fundus. The central vision of the other eye was two thirds, that of the involved eye one half. There are also a fundus drawing and two visual fields. (References.)

W. H. Crisp.

PAN-AMERICAN NOTES

Edited by Dr. M. Uribe Troncoso
500 West End Avenue, New York 24

Communications should reach the editor by the 12th of the month

Societies

The Sociedade de Oftalmologia de São Paulo has elected the following officers to serve during the fiscal year 1946: President, Dr. Armando Gallo; Vice President, Dr. Jose Mendonça de Barros; General Secretary, Dr. Amedée Peret; Secretary, Dr. Paulo Aranha; Treasurer, Dr. Aureliano Fonseca.

The prize offered annually by the Sociedade de Oftalmologia de São Paulo was won this year by Dr. José de Freitas, graduate of the University of Minas Geraes. This prize was offered to doctors who, having graduated the year before from a recognized medical school, wish to specialize in ophthalmology. It is awarded on the merits of a 10-minute dissertation on one of 20 subjects which have previously been studied by the candidate, one of these being drawn by lot on the night of the prize giving.

During the month of December, 1945, Prof. Edmond Velter, the well-known French ophthalmologist, visited São Paulo. Prof. Velter read a paper at a meeting of the Sociedade de Oftalmologia de São Paulo, and the São Paulo ophthalmologists gave a dinner for him at which Dr. Pereira Gomes made a speech of welcome on behalf of his colleagues. Prof. Velter, accompanied by Dr. Herdocia, of Costa Rica, and Dr. Cintra Gordhinho, of São Paulo, then left for Campinas where they visited the ophthalmologic services and were given the opportunity of visiting a coffee "fazenda" in which they were greatly interested.

The Fifth Brazilian Congress of Ophthalmology is scheduled to convene in Salvador, Bahia, from June 28 to July 2, 1947. The following papers are included in the program: "Vision of Vehicle Drivers," by Dr. Pereira Gomes, São Paulo; "Abiotrophic Diseases of the Macula," by Dr. Carlos Damel, Buenos Aires; "Vitamins in Ophthalmology," by Dr. Joviano de Rezende, Rio de Janeiro; (this paper will be discussed by Dr. Geraldo Queiroga, Belo Horizonte, and Dr. Heitor Marback, Bahia; "Glaucoma," by Dr. Renato de Toledo, São Paulo; (this paper will be discussed by Dr. Jacques Tupinambá, São Paulo, and Dr. Ruy Rolim, Rio de Janeiro. Surgical demonstrations will also be given during the meeting. The local committee has arranged a program of excursions and visits to places of interest in Salvador.

Dr. Saul Fontoura has been elected President of the Sociedade de Oftalmologia e Otrrinolaringologia do Rio Grande do Sul for 1946.

The Sociedad Cubana de Oftalmología has elected the following officers who will serve until January 1948: President, Dr. Lorenzo Comas; Vice Presidents, Dr. Rodolfo Hernández and Dr. Miguel Mery; Treasurer, Dr. Candido Durán; Secretary, Dr. Oscar Horstmann, and Vice Secretary, Dr. Tomas R. Yanes. At its first meeting in 1946 the Society agreed to hold the First National Congress of Ophthalmology in January 1947, with a symposium on the surgical treatment of cataract.

The first Congress of Medicine in Mexico was held in Mexico City from August 4 to 10, 1946. Although the Mexican Medical Association had held meetings since 1931, the association was transformed into a medical syndicate and, during the war, meetings were suspended. This first postwar Congress was held under the auspices of the Medical Society of the General Hospital and was very well attended. Important papers were read in the sections of Medicine, Hematology, Micro-Biology, Parasitology, Pathology, and Allergy.

The first Pan-American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology was held at the Palmer House, on October 17, 18 and 19, 1946. It was sponsored by the American Academy of Ophthalmology and Otolaryngology. The Latin-American participants were invited to attend the meeting of the American Academy which opened on Sunday, October 15th. The inaugural session of the Pan-American Congress took place on the night of October 17th with a Pan-American dinner, and the first scientific meeting was held jointly with the final session of the Academy on the morning of October 18th.

The Sociedad Cubana de Oftalmologia has started work on the organization of the third Pan-American Congress of Ophthalmology which is scheduled to convene in Havana in February, 1948. The Cuban government will provide all the necessary facilities and sponsor the event, as the importance of this meeting is well recognized by all.

Miscellaneous

The second number for 1945 of the publication, *Estudios de Informaciones Oftalmológicas* contains the following articles: B. Perpiña Robert, "Blue Sclerotics"; I. Barraquer, "Sclerocorneal Suture in Cataract Operations"; J. Barraquer Moner, "New Method of Corneal Section in Total Extraction of Cataract"; R. Almeida Ribeiro, "Congenital Cataracts and Phacolysis." These papers are illustrated with beautiful figures.

Personals

Dr. A. Moreu. *El Problema del Glaucoma Verum* (The Problem of Glaucoma Verum): The distinguished Spanish ophthalmologist, Dr. Moreu, of Valencia, has just published an interesting book of 336 pages with numerous illustrations dealing with ocular tension, primary and secondary glaucoma and their treatment, both medical and surgical. Although a review of this book is forthcoming, we want to point it out to all those ophthalmologists who speak Spanish.

NEWS ITEMS

Edited by Donald J. Lyle, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

Deaths

Dr. Mary Buchanan, Philadelphia, Pennsylvania, died August 8, 1946, aged 76 years.

Dr. Thomas Edward Carmody, Denver, Colorado, died August 27, 1946, aged 71 years.

Dr. Robert K. Lambert, New York, New York, died October 3, 1946, aged 47 years.

Dr. Richard Joseph Tivnen, Chicago, Illinois, died August 27, 1946, aged 71 years.

Miscellaneous

The Division of Ophthalmology of the University of California announces the receipt of a gift of $20,000 donated by Mrs. Francis I. Proctor for the establishment of a yearly lecture in ophthalmology in memory of her husband. The first Francis I. Proctor Lecture will be given on Friday, December 20th, at the University of California Medical School in San Francisco by Dr. Kenneth Swan of the University of Oregon. His subject will be "Some Contemporary Concepts of Pharmacology and Toxicology of the Cornea." The lecture is open to all ophthalmologists.

Dr. Francis I. Proctor was born in Boston in 1864. After his preliminary education, he attended and was graduated from the Harvard University Medical School in 1892. Following graduation, he went into the specialty of ophthalmology and eventually became Chief Surgeon of the Massachusetts Eye and Ear Infirmary.

On retirement he settled in Santa Fe, New Mexico, and became consultant in ophthalmology to the Office of Indian Affairs. While here, he became interested in trachoma, and it was he who induced Noguchi to make his studies in trachoma. When Thygeson was unable to confirm Noguchi's work, Dr. Proctor went to Denver to interview Thygeson and this established a friendship that lasted until his death. After Noguchi's death, it was Dr. Proctor who stimulated and participated in the work that was eventually to establish a filterable virus as the causative agent of trachoma. In addition, it was Dr. Proctor's generosity and determination that made possible the final confirmation of the etiology of trachoma. While Dr. Proctor did very little of the original work on trachoma, he traveled the world over to interview personally all who were doing outstanding work in the field, and it was his enthusiasm and encouragement that made possible the final solving of this problem.

It was Dr. Proctor's interest in furthering ophthalmology in the western part of the United States that resulted in the establishment of this lecture on the Pacific Coast. It is the plan of the Division of Ophthalmology to have one of the outstanding figures in the field of ophthalmology deliver the lecture each year.

The Ophthalmological Study Council opened its second course at the Hotel Soreno, St. Petersburg, Florida, on November 2nd. The course will continue through January 15th. Included among those presenting the basic subjects in the field of ophthalmology are:

Dr. Joseph Igersheimer, Boston, November 4-12, Sensory Neuro-Ophthalmology perimetry.

Dr. Herman Burian, Boston, November 13-23, Motor Neuro-Ophthalmology.

Dr. Georgiana Theobald, Oak Park, Illinois, November 25-30, General Pathology and Special Pathology.

Drs. Everett Goar, Dallas; Milton Berliner, New York; Robert Masters, Indianapolis; and Harvey E. Thorpe, Pittsburgh, December 2-7, Slitlamp Biomicroscopy.

Dr. Placidus J. Leinfelder, Iowa City, December 9-11, Practical Perimetry in Sections.

Dr. Algernon Reese, New York, December 12-14, Pathology—Tumors.

Dr. Cecil O'Brien, Iowa City, December 16-21, Surgical Principles, Pathology, Retina, Choroid and Optic Nerve and Ophthalmoscopy.

Drs. Walter B. Lancaster, Boston; Paul Boeder, Southbridge, Massachusetts; and Arthur Linksz, New York, November 4-16, Optics, Visual Physiology.

Drs. S. Judd Beach, Portland, Maine; James J. Regan, Boston; and W. B. Lancaster, Boston, November 18-27, Refraction Theory and Practice.

Dr. Trygve Gunderson, Boston, November 28-December 5, Pathology of Cornea and External Diseases.

Dr. Phillips Thygeson, San Jose, California, December 6-14, Bacteriology.

Dr. Albert N. Lemoine, Jr., Kansas City, Missouri, December 16, Anatomy, Histology, Embryology, Heredity.

Dr. Peter Kronfeld, Chicago, January 1-9, Pharmacology.

Dr. Paul Chandler, Boston, January 10-13, Glaucoma.

V. Everett Kinsey, Ph.D., Boston, January 1-9, Biochemistry.

Dr. Henry Wagener, Rochester, Minnesota, January 10-15, Medical Ophthalmology and Ophthalmoscopy.

Additional information may be obtained from Dr. Walter B. Lancaster, 520 Commonwealth Avenue, Boston.

An eye clinic on wheels was dedicated in special ceremonies at Trenton, New Jersey, October 12. The unit is said to be the first mobile clinic for providing eye care in remote areas in the country. Nineteen feet long and more than 6 feet wide, the unit contains a refracting chair, refractor, slitlamp, retinoscopes, and ophthalmoscopes. Diagnosis of eye diseases, minor treatments and operations, along with examination of eyes for glasses can now be made readily available in all areas. The new eye clinic is similar to the mobile optical units used overseas by the armed forces.

The Department of Ophthalmology, University of Toronto, has undertaken post-graduate training during the past year. This has been aided by a generous annual grant from Mr. Percy Hermant for establishing Fellowships in Ophthalmology. The post-graduate training is now three years for the Fellows. The first year's work is in the basic sciences of Ophthalmology, and the final two years are spent in clinical interneships in one of the Toronto hospitals. Dr. J. R. Gaby, Toronto, and Dr. A. W. Mahood, Vancouver, have been appointed Fellows for the current year. In addition to the Fellows, there are a number of two-year clinical interneships in Ophthalmology.

The graduate instruction in Ophthalmology in the hospitals in Toronto has been coördinated under the direction of the University. Didactic lectures are presented weekly from October until May to the internes by the members of the teaching staff in Ophthalmology. On Saturday mornings, ward rounds are made at the Toronto General Hospital and are attended by the internes in Ophthalmology from the various hospitals.

The internes are rotated through the Department of Ophthalmology of the Hospital for Sick Children in order that they may become familiar with the medical and surgical procedures of children's Ophthalmology.

The senior internes are given instruction in the preparation and presentation of scientific papers, and each one presents a paper at the Toronto Academy of Medicine, Section of Ophthalmology.

There have been a number of changes in the teaching staff in the University Eye Department. Dr. Walter W. Wright has retired as Professor of Ophthalmology in the University and Head of Ophthalmology in the Toronto General Hospital. He has been appointed Professor Emeritus. Dr. A. J. Elliot succeeds Dr. Wright. Dr. A. E. MacDonald and Dr. A. Lloyd Morgan have been made Assistant Professors of Ophthalmology and the teaching staff of the university department has been increased by the appointments of Dr. J. S. Crawford, Dr. C. E. McCulloch, Dr. J. C. Hill, and Dr. M. E. Albertson.

The George Washington University Department of Ophthalmology is planning the resumption of the intensive post-graduate courses in Ophthalmology, the next course to be given the week of February 3 to 8, 1947. These courses were discontinued during the war. The following guest lecturers are assisting the resident staff on the program: Dr. F. Heed Adler, Philadelphia; Dr. J. Mason Baird, Atlanta; Dr. S. Judd Beach, Portland, Maine; Dr. Herman M. Burian, Boston; Dr. Ramon Castroviejo, New York; Dr. C. Alvin Clapp, Baltimore; Dr. F. Bruce Fralick, Ann Arbor, Michigan; Dr. Deane B. Judd, Washington, D.C.; Dr. Peter C. Kronfeld, Chicago; Dr. Walter I. Lillie, Philadelphia; Dr. Angus L. MacLean, Baltimore; Mr. Philip L. Salvatori, New York; Dr. Harold G. Scheie, Philadelphia;

Dr. Edmund B. Spaeth, Philadelphia; Dr. Frederick W. Stocker, Durham, North Carolina.

The 10th annual post-graduate course in ocular surgery, pathology, and orthoptics will be given during the week of January 27-February 1, 1947. This is a practical course and limited to 30 participants.

For further details write to the Secretary, Mary Everist Kramer, Suite 34, 1801 K Street N.W., Washington 6, D.C.

Plans for a new $4,500,000, 10-story clinic and hospital for the 126-year-old New York Eye and Ear Infirmary were outlined by Dr. John P. Ruppe, infirmary superintendent, at the annual dinner of the infirmary's former internes, attended by 100 physicians at the University Club, 1 West 54th Street.

The hospital will adjoin the proposed New York University-Bellevue Medical Center between 30th and 34th streets on East River Drive, he said. He forecast completion in three to five years.

Amalgamated since February with the New York University-Bellevue Medical School, the infirmary has begun joint teaching and research activities with the school.

Dr. Currier McEwen, Dean of the New York University-Bellevue Medical School, told the alumni that identities of the two amalgamated institutions would be kept separate, although both would gain by their affiliation.

The opening address of the program was given by Dr. Conrad Berens. Mr. Hugh E. Paine, treasurer of the Board of Directors spoke on: "Mission of Trustees in Furthering Association of the Infirmary and New York University." Dr. Edward H. Cary, speaker of the evening, talked on: "Future Plans of the New York Eye and Ear Infirmary." Other guest speakers were: Dr. Daniel B. Kirby, Dr. J. Morrisset Smith, Dr. Joseph Kelly, Dr. Clyde E. McDannald, Dr. Bernard Samuels, and Dr. Edgar Burchell.

Societies

On Thursday, November 21st, Dr. Algernon B. Reese of New York delivered the ninth annual deSchweinitz Lecture at a meeting of the Section on Ophthalmology, College of Physicians of Philadelphia. Dr. Reese's subject was "Pigmented Tumors."

The Milwaukee Oto-Ophthalmic Society met on October 22nd at the Milwaukee Athletic Club. The program included a talk by Dr. Edward Waldeck on "Pulsating Exophthalmos —Presentation of a Case"; and a paper by Dr. Walter Reinking (by invitation) on "Practice of Otolaryngology in Mexico City."

Among the many interesting topics on the program of the 1946 conference of the National Society for the Prevention of Blindness, Inc., held at the Hotel Pennsylvania, New York, November 25th, 26th, and 27th were:

The vision program in industry

Chairman: Thomas D. Allen, M.D., Chicago, Member, Joint Committee on Occupational Ophthalmology, American Academy of Ophthalmology and Otolaryngology and American Medical Association.

1. Is Industry Measuring Up to Modern Standards of Eye Health and Protection? Leonard Greenburg, M.D., New York, Executive Director, Division of Industrial Hygiene and Safety Standards, New York State Department of Labor.
2. Professional Guidance in the Plant Program (Panel Discussion)
   Discussion Leader: T. Lyle Hazlett, M.D., Pittsburgh, Medical Director, Westinghouse Electric and Manufacturing Company.
   Medical Aspects, L. Holland Whitney, M.D., New York, Director, Employee Health and Safety, American Home Products Corporation.
   Ophthalmologic Aspects, Hedwig S. Kuhn, M.D., Hammond, Indiana, Secretary, Joint Committee on Occupational Ophthalmology, American Academy of Ophthalmology and Otolaryngology and American Medical Association.
   Optometric Aspects, Richard Reinberg, O.D., Lafayette, Indiana, Industrial Vision Institute, Purdue University.
   Optical Aspects, C. P. Carlsen, New York, President, New York State Guild of Prescription Opticians.
   Nursing Aspects, Bethel J. McGrath, R.N., Minneapolis, Industrial Nursing Consultant, American Association of Industrial Nurses.

Developmental eye conditions in Children

Chairman: Conrad Berens, M.D., New York, Executive Surgeon in Ophthalmology, New York Eye and Ear Infirmary.

1. Congenital and Hereditary Conditions, Harold Falls, M.D., Ann Arbor, Mich. Associate Professor of Ophthalmology, University of Michigan Medical School, and Associate Research Geneticist, Heredity Clinic, University of Michigan.
2. Retrolental Fibroplasia, Paul M. Runge, M.D., Boston, Senior Clinical Assistant, Massachusetts Eye and Ear Infirmary.
3. Congenital Cataract Associated with German Measles, Herbert Miller, M.D., Kansas City, Kansas, Professor of Pediatrics, School of Medicine, University of Kansas.

Open Discussion.

MEDICAL ADVANCES IN RESTORING AND CONSERVING VISION

Chairman: R. TOWNLEY PATON, M.D., New York, Vice-President, Eye Bank for Sight Restoration, Inc.

1. Corneal Transplant (Talk with Motion Picture), HERBERT KATZIN, M.D., New York, Head, Laboratory of the Eye Bank for Sight Restoration, Inc.
2. Sulfa Therapy in Ocular Infection, FRED LOE, M.D., Carson City, Nevada.
3. Penicillin Therapy in Ocular Infections, RAYMOND G. INGALLS, M.D., New York, Assistant Ophthalmologist, Institute of Ophthalmology, Presbyterian Hospital.

GLAUCOMA CONTROL THROUGH COMMUNITY PROJECTS (PANEL DISCUSSION)

Chairman: WILLIS S. KNIGHTON, M.D., New York, Chairman, Committee on Glaucoma, National Society for the Prevention of Blindness, Inc.

Participants:

MARGARET R. OSTERMAN, Washington, D.C., Executive Director, D. C. Society for Prevention of Blindness.

EVELYN CARPENTER, Philadelphia, Pennsylvania, Director, Philadelphia Committee for Prevention of Blindness.

PETER KRONFELD, M.D., Chicago, Illinois Eye and Ear Infirmary.

JAY G. LINN, M.D., Pittsburgh, Falk Clinic, University of Pittsburgh.

DOROTHY HAMILTON, St. Paul, Executive Secretary, Minnesota Society for the Prevention of Blindness and Conservation of Vision.

ALVA TROTTER, New York, Social Worker, New York State Department of Social Welfare.

The Washington D. C. Ophthalmological Society has elected the following officers: Dr. Richard W. Wilkinson, president; Dr. Edward J. Cummings, vice president; Dr. Jerome A. Sansoucy, secretary-treasurer; Dr. J. Thomas Schnebly and Dr. John R. Lloyd, members of the executive committee.

The dates of the meetings for the 1946-1947 season are: November 4th, January 5th, March 3rd, May 5th, and a special meeting February 3d, with the George Washington University post-graduate course. The meetings are held in the auditorium of the District of Columbia Medical Society Building, 1718 M Street, N.W., at 7:30: P.M.

PERSONALS

The Snyder Ophthalmic Foundation has given to Dr. K. W. Ascher a grant of two thousand dollars for research on aqueous veins at the College of Medicine, University of Cincinnati.

Dr. Richard C. Gamble has been appointed corresponding secretary of the Chicago Ophthalmological Society. He succeeds the late Dr. Robert Von der Heydt.

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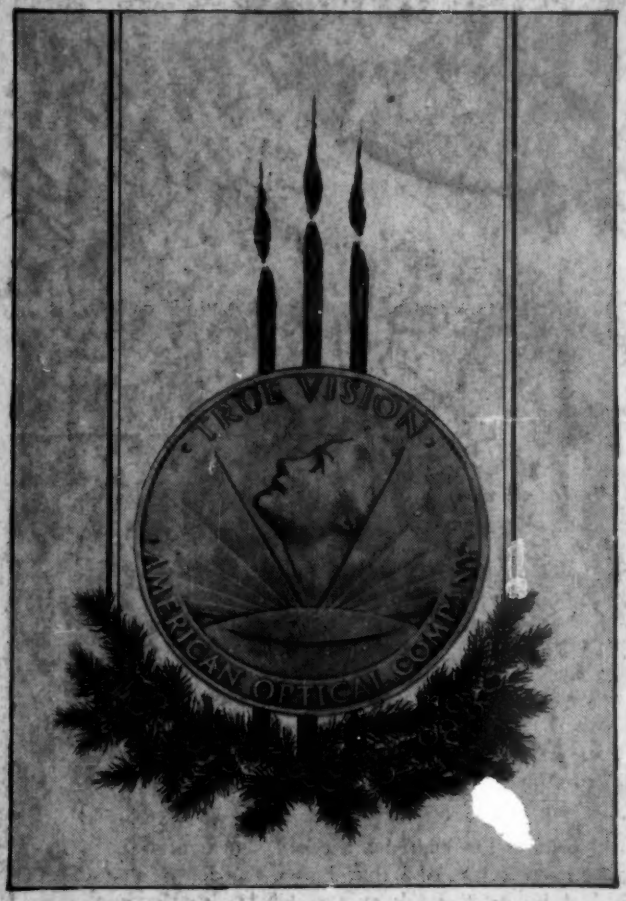

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